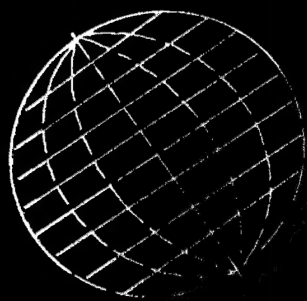


# **Planning of Manufacturing Science and Technology Activities with Industry**



***PLANNING OF MANUFACTURING  
SCIENCE AND TECHNOLOGY ACTIVITIES  
WITH INDUSTRY***



**NCAT**

***FINAL REPORT***

***OFFICE OF NAVAL RESEARCH  
GRANT No. N00014-96-1-0557***

***FROM JANUARY 26, 1996 THROUGH – DECEMBER 31, 1999***

***NCAT REPORT NUMBER 02-NG-2A***

***THE NATIONAL CENTER FOR ADVANCED TECHNOLOGIES  
WASHINGTON D.C. 20005***

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This Final Report presents a summary overview of the activities of the National Center for Advanced Technologies (NCAT) in fulfillment of Office of Naval Research Grant N00014-96-1-0557 including various Grant amendments and modifications.

# Table of Contents

	<u>Page No.</u>
<b>Executive Summary.....</b>	<b>1</b>
<b>Introduction .....</b>	<b>5</b>
Background .....	5
Affordability .....	6
NCAT Industry Affordability Task Force .....	8
Report Constraints and Parameters .....	11
<b>NCAT Program Activities within the Scope of the Grant .....</b>	<b>13</b>
Program Summary for 1996 .....	13
Program Summary for 1997 .....	15
Program Summary for 1998 .....	15
Program Summary for 1999 .....	18
<b>Summaries Of Major Project, Organizational, and Program Activities Conducted By NCAT Under This Grant .....</b>	<b>21</b>
Overview .....	21
Multi-Association Industry Affordability Task Force .....	21
Defense Manufacturing Council (DMC) Support .....	22
Characterization of Commercial Parts .....	24
S & T Affordability Workshops/Conferences .....	24
Process Maturity .....	31
Quick Review of DODD 5000.1 and DODI 5000.2 .....	31
Integrated Product/Process Development Activities .....	32
Dual-Use Technology .....	33
Defense Manufacturing Conferences .....	34
Process Effectiveness .....	35
Evolutionary Defense Acquisition .....	35
International Cooperative Agreements .....	36
COSSI Perspectives .....	37
Sustainment .....	38



	<u>Page No.</u>
<b>Spin-On Technologies .....</b>	<b>40</b>
<b>Manufacturing Technology Roundtables .....</b>	<b>41</b>
<b>Technology Area Review &amp; Assessments .....</b>	<b>43</b>
<b>Summary .....</b>	<b>43</b>
 <b>Appendices</b>	
<b>A. Minutes from Representative Meetings of the NCAT Industry Affordability Task Force .....</b>	<b>45</b>
<b>B. 1996 S&amp;T Affordability Conference Agenda .....</b>	<b>61</b>
<b>C. S&amp;T Affordability Conference Critique Results .....</b>	<b>65</b>
<b>D. 1997 S&amp;T Affordability Conference Agenda .....</b>	<b>69</b>
<b>E. 1998 S&amp;T Affordability Conference Agenda .....</b>	<b>73</b>
<b>F. Process Maturity .....</b>	<b>79</b>
<b>G. Process Effectiveness Assessment .....</b>	<b>97</b>
<b>H. Evolutionary Defense Acquisition White Paper .....</b>	<b>107</b>
<b>I. International Cooperative Opportunities White Paper .....</b>	<b>115</b>
<b>J. An Industry Perspective of the COSSI Program .....</b>	<b>121</b>
<b>K. Sustainment Report .....</b>	<b>131</b>
<b>L. "Spin-On" Technologies for Affordability .....</b>	<b>167</b>
<b>M. Sample of Round Table Proceedings and Briefings .....</b>	<b>209</b>
 <b>Standard Form 298 .....</b>	 <b>222</b>

## **Executive Summary**

The National Center for Advanced Technologies (NCAT), a not-for-profit research and education foundation in Washington DC, performed planning and implementation tasks pertaining to the Manufacturing Science and Technology programs of Office of Naval Research (ONR), Science and Technology (S&T), Affordability projects for the Director of Defense Research and Engineering (DDR&E), and various assessments of the private sector for the Defense Technology Assessment Office, and the Defense Manufacturing Council during the period of this Grant.

The objective of the NCAT program under the scope of this Grant was, in general, to provide planning assessment and criteria, identify potential issues and their possible resolution, and define potential pilot programs and action plans to support the manufacturing science and technology programs. Though not acting in any advisory capacity, the Center, through its "Window to Industry," also provided timely, responsive, high-quality, private-sector assessments and feed-back on Department of Defense (DoD) plans and policies in several areas, identifying issues for resolution, and defining action plans that supported the Government's affordability initiatives. Programs and initiatives such as the Dual-Use Application Program initiatives, the Commercial Operations & Support Savings Initiative (COSSI) program, International Cooperative Agreement initiatives, and Follow on (second generation) Acquisition Reform initiatives were supported.

The Center also assisted in the preparation for and support to various DoD Acquisition Reform activities, the focus of which was on improved Government-Private Sector (Industry and Academia) teamwork. The Grant provided continued support to the Defense Systems Affordability Council, which was previously convened as the Defense Manufacturing Council. Through this Grant the Government, through NCAT, continued to obtain the high level, responsive private sector feedback needed to make, or recommend, informed decisions, especially those related to retaining and strengthening a qualified industrial base in order to meet national security needs.

The Center provided support for facilitating the DoD S&T Affordability Task Force workshops, opportunities for private sector recommendations on Integrated Product and Process Development training for S&T program managers, and continued Industry dialogue on Manufacturing Technology program policy issues. It also performed planning and implementation tasks pertaining to the Manufacturing Science and Technology programs of the ONR, the Director of Defense Research & Engineering, the Defense Technology Analysis Office, and the Defense Systems Affordability Council. The Center performed this support of these and other organizations by assembling and coordinating a broad range of private sector viewpoints, through an ever expanding participation of Private Sector Companies, Trade Associations, Professional Societies,

Universities, and Manufacturing Centers of Excellence, relative to manufacturing affordability and related activities devoted to reducing unit and life cycle support costs.

Throughout this Grant period, the Center continued to accomplish its role of acting as the Secretariat for the Multi-Association Industry Affordability Task Force, convening focused workshops and informal working groups of Private Sector, University, and Government Executives to address problems identified by its Executive Committee and/or DoD and Military Service executives. The Center also

- Convened focused workshops and informal working groups of Industry, University, and Government representatives as requested by the Deputy DDR&E (Laboratory Management and Technology Transition);
- Continued to provide awareness of DoD affordability activities to and across the Private Sector and Academia; and
- Defined/described potential pilot programs to demonstrate concepts formulated by Industry experts in response to Government agency queries.

As in the initial years of similar Grant activities, the Center maintained an information system to insure distribution of meeting related reports and other Industry products throughout Government, Industry, and Academia.

The Center also became the Industry catalyst for the prestigious annual Defense Manufacturing Conferences and participated in numerous other Industry Association and company conferences, workshops, and symposia.

A summary of the major research and analysis products delivered and events held in the term of this Grant included:

- Three DMC/Industry Affordability Conferences/Workshops (1996-1998)\*
  - October 1996 S & T Affordability Workshop\*
  - June 1997 S & T Affordability Workshop\*
  - Critique Results and Proceedings of the S&T Affordability Workshop\*
  - June 1998 S & T Affordability Workshop\*
- Numerous Government-Industry Roundtables (1996-1998)\*
- Industry Review of the Revised Draft DoD Directive 5000.1 and DoD Instruction 5000.2 (1996)
- Summary Report and Recommendations for Accelerating the Use of Commercial Integrated Circuits in Military Systems
- Defense Manufacturing Excellence Awards (1996-1999)
- International Cooperative Opportunities White Paper (1996)\*
- Evolutionary Defense Acquisition White Paper (1996)\*

- Process Maturity White Paper (1996)\*
  - Process Effectiveness Recommendations to DoD (1996)\*
  - Industry Perspective of the Commercial Operations and Support Savings Initiative (COSSI) Program (1997)\*
  - “Spin-On” Technologies for Affordability (1998)\*
  - “Sustainment” Report (1998)\*
- (\*) Indicates the document(s) describing all or a significant part of the activity or event (Proceedings, Final Report, White Paper, Agenda, etc.) may be found within the Appendices to this Final Report

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# Introduction

## Background

The National Center for Advanced Technologies (NCAT) was founded as a non-profit research and education foundation to provide a bridge between Government, Industry, and Academia, and to encourage cooperative efforts on technology development.

NCAT's initial years were dedicated to the development and publication of eight national strategic plans for technology development under the umbrella program "Key Technologies for the Year 2000." NCAT initially developed and published eight national strategic plans for technology development, later focusing its efforts to studies and assessments of affordability of manufacturing processes. The "Key Technologies" efforts were used as a model to facilitate cooperative efforts of the Private Sector, Academia, and Government to seek answers for accelerating technology transition to products, and fostering timely, cost-effective implementation of modern techniques of technology/process development. To achieve these objectives the Center recruited an Industry Task Force consisting of an Executive Steering Group and several unique Task Teams for specific projects who worked within the triad of Industry, Academia, and Government. The Task Force enjoyed the participation of many prominent executives from Industry and nationally recognized academicians from colleges and universities in the United States as well as the participation of key Government officials from several Agencies. This core group was routinely expanded to embrace a wider spectrum of expertise from Industry, including private sector commercial firms and their respective Industry Associations when it was necessary to address more global issues. On completion of that "Key Technologies" program in 1992, NCAT turned its efforts toward "Affordability."

While Commercial Industry understood affordability very well (with market forces encouraging and enforcing that understanding), Government Agencies generally accorded top priority to technical performance—and cost, especially life-cycle cost, became at best a secondary consideration. To reconcile these different perspectives, NCAT developed a "Big Picture" view of Affordability centering on the efficient application of product and process technology.

The original objectives of the National Center for Advanced Technologies were expanded to include:

- Facilitating cooperative efforts between Government, Industry, and Academia for accelerating technology transition to products.

- Fostering timely, cost-effective implementation of modern techniques of technology/process development (such as Integrated Process and Product Development, or IPPD).

Early on NCAT developed a rapport between Industry, Government, and Academia. The relationship was based on trust and cooperation in areas of mutual interest. The concept represented a truly new perspective. Rather than an adversarial relationship, the new look that NCAT provided became a model for continuous Industry dialogue with the Department of Defense (DoD). It was soon determined by the success of the DoD-Industry relationship that the model could well be applied to other Industry/Government relationships.

While NCAT was growing, it developed a process that provided both a top-down and a bottom-up perspective on issues of interest. This process, which includes a high-level policy group and a series of subgroups working specific topics, was applied effectively to activities for the DoD, National Aeronautics and Space Administration, and the National Science and Technology Council (see Figure 1).

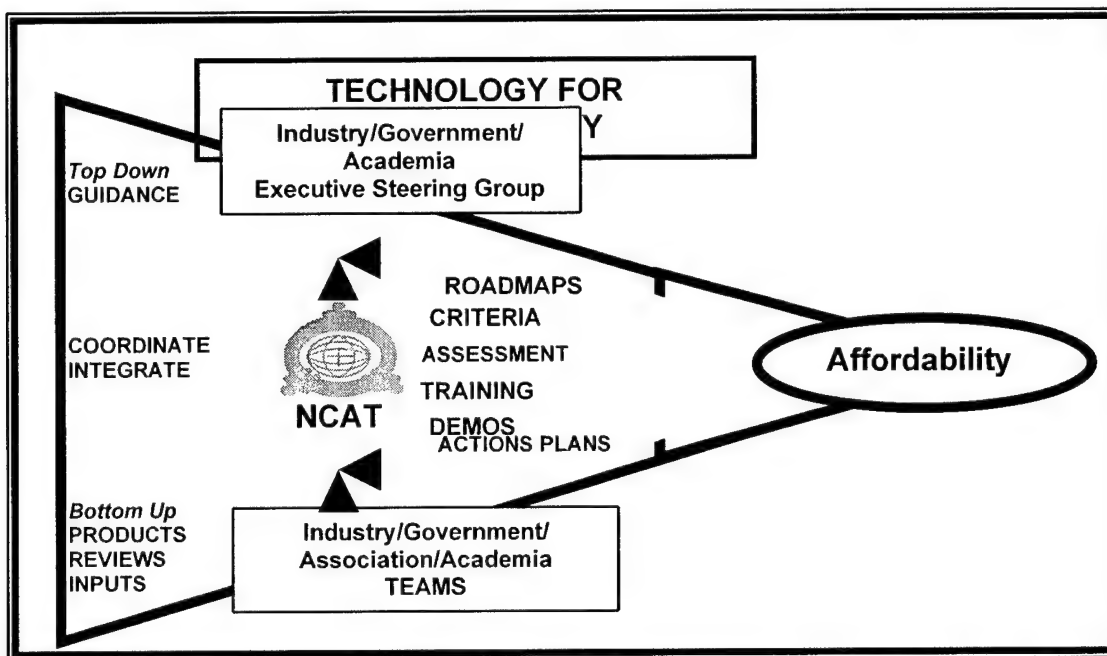
## Affordability

Concurrent with its Multi-Agency activities, NCAT started a long-term effort with Department of Defense to emphasize affordability in both technology demonstrations and in weapon system development. This activity started with the formation of an Industry Steering Group and various Task-oriented Teams for work on specific projects. NCAT's work with Industry and Government was based on the framework of the Key Technologies effort. Figure 1 shows the concept and Figure 2 shows the make up of the executive committees throughout the period of the Grant for the Multi-Association Industry Task Force for Affordability.

This simple model of activities depicted a tried and true method that the National Center for Advanced Technologies had successfully used to work various significant Industry/Government issues in the past. Volunteer *pro bono* members filled the Industry/Government/Association/Academia teams. From the viewpoint of the Industry contributors of executive manpower, their return on the significant personnel time investment was seen to be the ability to

- To be informed of new Government policies and policy changes and
- To affect Government policy that could in turn have an effect on the organization that sponsored the participant.

Whether it was a Government agency or a private sector company, an academic institution, or a professional organization, each had something to offer and much (potentially) to gain. Even if the advice and feedback offered sometimes did not affect policy (not always obvious); based on feedback from Industry to NCAT, at least these Industry contributors knew their voices had been heard and listened to and they considered that a worthwhile return.



**Figure 1. The Concept of Operations for NCAT Activities**

The results of this activity, brokered by NCAT, came to be the clearest, quickest, simplest method for the Government (especially the DoD) to achieve a “sounding board” review of policies in-work, procedure after promulgation, or distribution of best practices. Variations on top-down/bottom-up efforts were repeated throughout the history of this Grant. It was the truly the “honest broker” approach; bringing the right people into the activities that provided the best window to the industries that existed to produce Government requirements and products.

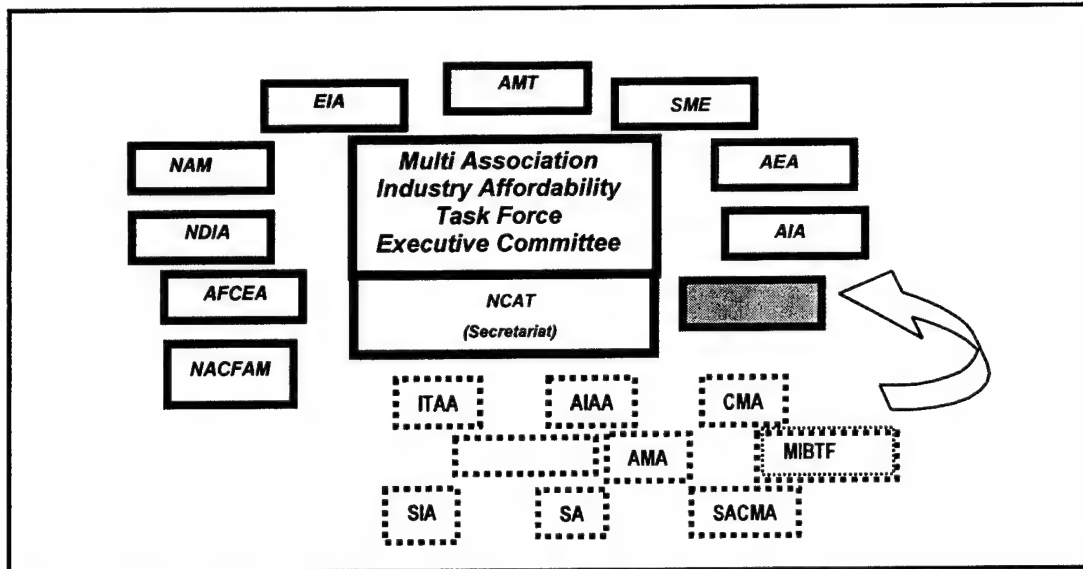
Initially seven Trade Associations and Professional Societies joined NCAT in the project that delved into Affordability. This group rapidly expanded to ten that then formed the initial core of Industry representation. As shown below\*, they included the:

- Aerospace Industries Association (AIA)
- Armed Forces Communications/Electronic Association (AFCEA)
- American Electronics Association (AEA)
- Association for Manufacturing Technology (AMT)
- Electronic Industries Alliance (EIA)
- National Association of Manufacturers (NAM)
- National Center for Manufacturing Sciences (NCMS)

\* Current year (2002) Association and Professional Society names have been used for clarity and relevance



- National Coalition for Advanced Manufacturing (NACFAM)
- National Defense Industrial Association (NDIA)
- Society of Manufacturing Engineers (SME)



**Figure 2. Other Associations Join NCAT Activities as Required**

NCAT also contacted other Associations and organizations whose interests were affected by Government or who could add a pure private sector input to an issue contemplated by the Government-Industry-Academia task force. On occasion the need to expand the perspective for a purely critical industrial viewpoint required that NCAT recruit other sectors to participate. As an illustrative example, at one such occasion, in response to the DoD's Technology Reinvestment Program, representatives from twenty-five different Associations, Professional Societies, and Academic Institutions were solicited and participated. A pictorial representation of how the Task Force was augmented is provided in Figure 2 (above).

## NCAT Industry Affordability Task Force

As part of an effort to provide Industry expertise and viewpoints relative to Manufacturing Science & Technology, NCAT acted (and continues to act) as the secretariat for the Multi-Association Industry Affordability Task Force. This work included describing potential pilot programs for demonstrating and proofing concepts formulated by Industry expertise, maintaining an information system to insure distribution of meeting-related reports and other Industry products, and disseminating results throughout Government, Industry, and Academia to participants in the Task Force and other related team efforts.

The NCAT Affordability Task Force was created in 1993 to pursue studies in affordability at the request of the DoD's Director of Defense Research and Engineering. It has persisted to the present time in various forms and evolutions. It is anticipated that this formula will continue in the future as NCAT is requested to provide further Industry viewpoints to various Government agencies, including the Office of the Secretary of Defense and the individual Military Services.

As mentioned, the Affordability Task Force originally was supported with voluntary resources from seven Industry Associations and Professional Societies:

- Aerospace Industries Association (AIA)
- Electronics Industry Association (EIA)
- American Defense Preparedness Association (ADPA)<sup>†</sup>
- American Electronics Association (AEA)
- Society of Manufacturing Engineers (SME)
- Association for Manufacturing Technology (AMT)
- National Security Industrial Association (NSIA)<sup>2</sup>

This core group expanded to embrace a wider spectrum of Industry, including private sector commercial firms and their respective Industry associations. Specific projects requested by the customer necessitated the expansion of Industry representative groups to gather the most accurate consensus. As a result of one project, 23 Associations and Professional Societies were invited to participate in a working session the results of which were provided as an "Industry Viewpoint" to a particularly nettlesome Government policy construction. Because of its balance, this formula was replicated repeatedly in response to the hunger of various Government Agencies for accurate, fair and balanced inputs and information provided quickly and directly.

In addition to the Task Force and its functionally created project teams, ad-hoc volunteer Industry/Government teams have been operating together, under the coordination and orchestration of NCAT, to perform studies and workshop activities addressing problematic areas of concern to both Government and Industry. Typically, the Industry groups have responded or input an "Industry viewpoint" to Government operational activities. NCAT's value-added activity resulted in an "honest broker" effort to coalesce the consensus opinions and make input to the DoD as objective and non-parochial Industry opinions. These "sounding board" opinions have provided helpful inputs to many Government decision makers.

During this time the Task Force was fortunate to enjoy the participation of many prominent executives of Industry and nationally recognized academicians from colleges and universities in the United States. Over the years since the Task Force was formed the support from these organizations has been outstanding and the products produced of great

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<sup>2</sup> The ADPA and the NSIA later merged to form the National Defense Industrial Association (NDIA).

import to the Nation's manufacturing community. Top executives and academicians at the Executive Committee served the Task Force in the leadership role. This Executive Committee changed leadership once during the period of this grant. Some members of the executive committee also changed as positions within companies changed and personalities moved on to other facets in their lives. The distinguished past composition of the Executive Committees for the various periods covered by the Grant are shown on the next page.

#### **1996-1997 Industry Affordability Task Force Executive Committee Membership**

- |  |  |
|--|--|
| • Mr. Aris Melissaratos, Westinghouse<br>(Chair) | • Mr. Frank McCarty, SME                                 |
| • Mr. Robert Beschler, Pratt & Whitney           | • Mr. John Ramsey, Lockheed Martin                       |
| • Mr. Robert Cattoi, Rockwell<br>International   | • Mr. Herm Reininga, Rockwell<br>International           |
| • Ms. Dorothy Comassar, General<br>Electric      | • Mr. Lawrence Rhoades, Extrude Hone                     |
| • Dr. John DeCaire, NCMS                         | • Mr. Phil Roether, Texas Instruments                    |
| • Mr. Jerry Ennis, McDonnell Douglas             | • Dr. Joseph Rowe, University of Dayton                  |
| • Dr. Jacques Gansler, TASC                      | • Mr. Michael Saft, Saft Batteries                       |
| • Mr. Richard Jarman, Eastman Kodak              | • Dr. Daniel Schrage, Georgia Institute<br>of Technology |

#### **1997-1998 Industry Affordability Task Force Executive Committee Membership**

- |   |  |
|---|--|
| • Mr. James Sinnett, McDonnell Douglas<br>(Chair) | • Mr. Richard Jarman, Eastman Kodak                        |
| • Mr. Robert Beschler, Pratt & Whitney            | • Mr. Frank McCarty, Society of<br>Manufacturing Engineers |
| • Mr. Burt Birchfield, McDonnell<br>Douglas       | • Mr. Lawrence Rhoades, Extrude Hone                       |
| • Mr. Robert Cattoi, Rockwell<br>International    | • Mr. Phi Roether, Texas Instruments                       |
| • Ms. Dorothy Comassar, General<br>Electric       | • Dr. Joseph Rowe, University of Dayton                    |
| • Dr. John DeCaire, NCMS                          | • Mr. Michael Saft, Saft Batteries                         |
| • Dr. Jacques Gansler, TASC                       | • Dr. Daniel Schrage, Georgia Institute<br>of Technology   |
|   | • Mr. Paul Stone, Dow Chemical                             |

### **1998-1999 Industry Affordability Task Force Executive Committee Membership**

- Mr. James Sinnett, Boeing (*Chair*)
- Ms. Kay Adams, Pratt & Whitney
- Mr. Burt Birchfield, Boeing
- Mr. Robert Cattoi, Rockwell Corporation
- Ms. Dorothy Comassar, General Electric
- Dr. John DeCaire, NCMS
- Dr. L. R. Hettche, Pennsylvania State University
- Mr. Richard Jarman, Eastman Kodak
- Mr. Frank McCarty, SME
- Mr. Jim Price, Primex
- Dr. Herbert Rabin, University of Maryland
- Mr. Herm Reininga, Rockwell Collins
- Mr. Lawrence Rhoades, Extrude Hone
- Mr. Rusty Patterson, Raytheon/Texas Instruments
- Dr. Daniel Schrage, Georgia Institute of Technology
- Mr. P.D. Shabay, Bell Helicopter
- Mr. Doug Swiggart, Lockheed Martin

### **Report Constraints and Parameters**

With few exceptions, findings and recommendations made to the various study task sponsors are not included in the body of this report. This is a summary report only. Any applicable findings and recommendations have already been reported to the sponsors of each task (and in most cases already implemented). Accordingly, a separate Findings and Recommendations section is not included in this Final Report as it would be unnecessarily repetitious and duplicative of findings and recommendations already reported.

Many of the major activities covered in this Final Report have been documented and/or reported on elsewhere through individual reports and presentations as required by the sponsoring organization(s) that provided the funding. Where applicable, these other reports/presentations are noted and incorporated by reference in this Final Report or provided within the appendices to this Final Report.

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## **NCAT Program Activities within the Scope of the Grant**

### **Program Summary for 1996**

The National Center for Advanced Technologies (NCAT) performed planning and implementation tasks pertaining to the Manufacturing Science & Technology (S&T) programs of Office of Naval Research, the Director of Defense Research & Engineering (DDR&E), the Defense Technology Assessment Office (DTAO), and the Defense Manufacturing Council (DMC).

Specifically the Center conducted the following activities:

- Assembled and coordinated Industry expertise to provide viewpoints relative to Manufacturing Science and Technology activities and described potential pilots for demonstrating and proofing concepts formulated by Industry experts.
- As the Secretariat for the Task Force, managed the Multi-Association Industry Task Force on Affordability; maintained an information system to insure distribution of meeting related reports, minutes, and other Industry products; and disseminated the results throughout Government, Industry, and Academia.
- Supported the DDR&E, and the Defense Manufacturing Council and also planned and participated in activities for the Defense Manufacturing Conference and other related Conferences, workshops and symposia.
- Organized and conducted focused workshops and convened informal working groups of Industry, University, and Government representatives as requested by the DDR&E. Emphasis was placed on Technology for Affordability, but interactions with related areas were also identified as needed.
- Supported the DTAO in its role of providing engineering, scientific, and technical analysis for DDR&E, by supplying inputs from Industry, Academia, and various other Government Agencies (e.g. Department of Energy (DoE), the National Aeronautics and Space Administration (NASA), the Department of Commerce (DoC), etc.) on S&T plans and programs. NCAT representatives participated and/or arranged participation of Industry representatives in reviews of plans and programs as directed.

Acting as the Secretariat to the Multi-Association Industry Affordability Task Force, the Center scheduled and arranged Task Force meetings, and coordinated the activities of the various Task Teams, editing and publishing team reports and other products of the Task

Force, and maintained records of Task Force activities. As a part of its responsibilities as the Secretariat for the Task Force, the Center:

- Identified issues, solicited presentations from Industry and Department of Defense (DoD) speakers, and prepared draft agendas for meetings of the Task Force;
- Coordinated agenda items with the Chairman of the Executive Committee, the Task Force Team Chairs, and other members;
- Proposed and arranged for expanded expertise and attendance at meetings,
- Prepared advance materials and distributed them to the meeting attendees as appropriate,
- Prepared minutes and/or proceedings of all meetings as well as copied presentations made to the Task Force and distributed them to attendees and task team chairs;
- Followed up on all Executive Committee requests, action items, suspense items, and reported status as requested; and
- Made appropriate distribution of team results, findings, and reports to various DoD and other agencies and individuals outside the Task Team structure.

As new standing or ad hoc teams and committees were formed, NCAT solicited the appropriate staffing and ensured new team integration into the Task Force structure.

An essential element of the NCAT process has been and remains the inclusion of views and membership from a variety of Companies, Trade Associations, and Professional Societies. Throughout the period covered by this Grant, NCAT expanded this network and informed them of Task Force activities through periodic written reports and personal visits. As part of the overall planning assessment NCAT provided descriptions of potential pilot projects/programs for demonstrating and proofing concepts formulated by Industry expertise. Also, NCAT established and maintained a resource library of timely and appropriate publications pertinent to the Task Force activities.

Within the bounds of early activities in Affordability studies, the Center spread awareness of Affordability technology. This proved essential to its adoption and effective utilization. NCAT continually improved the development and maintenance of an awareness plan to facilitate the broad distribution of Task Force results. Two major symposia were planned at which the most significant actions and recommendations of the Task Force were to be presented to a broad audience for information and feedback. NCAT also continuously prepared curricula and syllabi of instruction in other technology management areas, similar to its development and publication in 1993, 1994, and 1995 of its widely known Integrated Product/Process Development (IPPD) instructional syllabus.

NCAT supported the preparations for and actively participated in the annual Defense Manufacturing Conferences during the period covered by this Grant. In addition the Center or its team members participated in appropriate related conferences and symposia.

In addition to the planned and scheduled activities, NCAT conducted studies, convened meetings, etc. as directed by the Contracting Officer or the Contracting Officer's representative. These are detailed elsewhere in this report.

## **Program Summary for 1997**

The 1997 program was brought about through modification of the original 1996 Grant program. It extended the duration of the Center's effort to 24 months after the original Grant award. The purpose of the Grant was stated as the continuation of the Center's activities in the following areas:

- Provision of:
  - Planning assessments and criteria,
  - Identification of potential issues impacting affordability (including the possible resolution to these issues), and
  - Definition of potential pilot programs and action plans that supported the DoD's manufacturing science and technology programs.
- In addition, the Center was to:
  - Identify and promulgate managerial processes and methodologies that supported efficiency increases in manufacturing;
  - Research and catalogue Industry cases that leveraged manufacturing science and technology practices; and
  - Research and prepare syllabi and curricula in management technology areas that were being successfully implemented in commercial and defense industries.

While the effort remained similar to the previous year's activities, it also expanded upon those activities. The Center planned, developed, and proposed efforts to integrate research, educational and training materials and facilities (research simulation workstations, educational centers for post graduate efforts, etc.) to affect necessary changes through collaborative Industry-Government-Academia research in current manufacturing management.

In addition, the Center was tasked to continue its previous activities in support of the DDR&E and the DMC and also to continue to act as the Secretariat for the Multi-Association Industry Affordability Task Force and its standing and special purpose Task Teams. The Center, often through the pro bono Industry resources of the Task Force, was able to respond to many short-notice and "quick response needed" requests for Industry input into DoD defense acquisition policy formulation activities in affordability, sustainment, dual use, etc.



## Program Summary for 1998

The objective of the 1998 program was to provide planning assessment and criteria, identify potential issues and possible resolution, and define potential pilot programs and action plans that supported the manufacturing science and technology programs. The Center supplied timely, responsive high-quality private-sector assessments and feedback on DoD plans and policies, especially those that could have affected the private sector. The activities of the Center and its Task Teams (centered on the Multi-Association Industry Affordability Task Force) identified issues for resolution, and defined action plans that supported the DMC's various affordability initiatives.

The additional program funding enabled a number of tasks that both built upon and amplified previous years' activities. These tasks and activities included support to:

- New DoD Dual-Use application initiatives including the Dual Use Application Program (DUAP) and the Commercial Operations & Support Savings Initiative (COSSI),
- International cooperation initiatives including the International Cooperative Opportunities Group, and
- Second-generation Acquisition Reform initiatives including providing assistance to DoD in the preparation for and support to Acquisition Reform Day II (which focused on improved Government-Private Sector teamwork).

The Center also continued its level of support to the DMC under the Grant by obtaining the requisite level and responsive private sector feedback needed to make, or recommend, informed decisions, especially those related to retaining a qualified industrial base.

The 1998 Grant program also continued a number of ongoing tasks including continued support for facilitating the S&T affordability workshops, providing opportunities for private sector recommendations on IPPD training for S&T program managers, and continued the Industry dialogue on Manufacturing Technology program policy issues.

The Center planned and implemented tasks pertaining to the Manufacturing Science and Technology programs of the Office of Naval Research, the DDR&E, the Defense Technology Analysis Office (DTAO), and the Defense Manufacturing Council. As in the past, NCAT:

- Assembled and coordinated a broad range of private sector viewpoints, including companies, trade associations, professional societies, universities and manufacturing centers of excellence, relative to manufacturing affordability and related activities devoted to reducing unit and life cycle support costs;
- Acted as the Secretariat for the Multi-Association Industry Task Force on Affordability, convening focused workshops and informal working groups of private sector, university, and Government representatives who possessed the skills needed to address identified problems requested by the DMC Executive Secretary;

- Convened focused workshops or informal working groups of Industry, University, and Government representatives as requested by the Deputy Director of Defense Research and Engineering (Laboratory Management/Technology Transition);
- Developed and executed an awareness plan to facilitate broadest distribution and awareness of DoD affordability activities across the private sector;
- Defined and described potential pilot programs to demonstrate concepts formulated by Industry experts in response to DMC queries;
- Facilitated DoD access to best Industry practices of training programs for IPPD tools;
- Promoted broad distribution of S&T affordability activities across Industry;
- Maintained an information system to insure distribution of meeting related reports and other Industry products; disseminate results throughout Government, Industry and Academia;
- Supported the DDR&E's and the Defense Manufacturing Council's activities for the Defense Manufacturing Conference;
- Participated in numerous Conferences, workshops, and symposia;
- Conducted studies, convened working group meetings, and undertook independent assessments as directed by the Contracting Officer;
- Held focused workshops and convened informal working groups of Industry, University, and Government representatives as requested by the DDR&E (these workshops and working groups focused mainly on "Technology for Affordability" but interactions with related areas were also identified); and
- Supported the DTAO in its role of providing engineering, scientific, and technical analysis for DDR&E.

In fulfilling the program objectives the Center also facilitated inputs from Industry, Academia and other Government agencies (e.g., DoE, DoC, NASA, etc.) on Science and Technology plans and programs.

As Secretariat to the Multi-Association Industry Affordability Task Force, NCAT scheduled and arranged Task Force meetings, and coordinated the activities of the various task teams, editing and publishing reports and other products of the Task Force, and maintained records of Task Force activities. Specifically for the Task Force, NCAT:

- Identified issues and prepared draft agendas for meetings of the Task Force,
- Coordinated agenda items with the Task Force Chair and other members,
- Proposed and arranged for expanded expertise and attendance at meetings,
- Prepared advanced materials and distributed to meeting attendees,
- Prepared minutes and/or proceedings of all meetings and distributed these documents to attendees and task team chairs,
- Followed up on all action items and reported status,

- Made distribution of team results, findings, and reports to Government Agencies and individuals outside the Task Team structure.

An essential element of the NCAT process was and is the inclusion of views and membership from a variety of Companies, Trade Associations, and Professional Societies. NCAT continued to expand this network, keeping them informed of the Task Force's activities through periodic written reports and personal visits. As new Task Force Teams and committees were formed, NCAT solicited for and obtained the appropriate staffing and ensured integration into the Task Force structure.

Major symposia were held at which the most significant actions and recommendations of the Task Force were presented to a broad audience for information and feedback. NCAT continued to refine curricula and syllabi of instruction in other technology management areas, similar to previous years of program activity.

## **Program Summary for 1999**

The objective of the 1999 program was similar to previous years' programs in the scope of this Grant. The Center continued to provide planning assessment and criteria, identifying potential issues and their possible resolution. Definition of potential pilot programs and action plans to support the manufacturing science and technology programs continued to be part of the overall objective. Through its "Industry Window" the Center continued to provide timely, responsive high-quality private-sector assessments/feedback on DoD plans and policies, especially those that could affect the private sector, identifying issues for resolution, and defining action plans that supported the Defense Manufacturing Council's affordability initiatives.

Overall, the 1999 Grant program constituted a further enhancement of previous years' activities. Funding enabled a number of tasks that amplified previous years' activities including continued support to:

- New DUAP initiatives,
- The COSSI program and International Cooperation Initiatives,
- Follow-on Acquisition Reform initiatives, and
- Prepare for and provide support to Acquisition Reform activities, the focus of which was on improved Government-private sector teamwork.

The 1999 Grant program also provided continued support to the Defense Systems Affordability Council (DSAC), which had previously convened as the Defense Manufacturing Council. As in past years, NCAT's activities under this Grant continued to make it possible to obtain high level, responsive private sector feedback needed to make, or recommend, informed decisions, especially those related to retaining a qualified industrial base.

The 1999 Grant program also continued several other ongoing tasks including:

- Continued support for facilitating the S&T Affordability Task Force workshops,
- Provision of opportunities and channels for private sector recommendations on IPPD training for S&T program managers, and
- Facilitation of continued Industry dialogue on Manufacturing Technology program policy issues.

The Center performed planning and implementation tasks pertaining to the Manufacturing Science and Technology programs of the Office of Naval Research, the DDR&E, the DTAO, and the DSAC. For these Manufacturing S&T programs NCAT assembled and coordinated a broad range of private sector viewpoints, through an ever expanding participation of private sector companies, Trade Associations, Professional Societies, Universities and Manufacturing Centers of Excellence, relative to manufacturing affordability and related activities devoted to reducing unit and life cycle support costs.

The Center also continued its role of Secretariat for the Multi-Association Industry Task Force on Affordability, convening focused workshops and informal working groups of private sector, university, and Government executives who addressed problems identified by the DMC/DSAC.

As in the previous years' programs the Center also:

- Convened focused workshops and informal working groups of Industry, university, and Government representatives as requested by the Deputy DDR&E (Laboratory Management/Technology Transition);
- Continued to provide awareness of DoD affordability activities across the private sector;
- Defined/described potential pilot programs to demonstrate concepts formulated by Industry experts in response to DSAC queries;
- Provided DoD access to best Industry practices and promoted broadest distribution of S&T affordability activities across Industry (as in the initial years of the grant activities);
- Maintained an information system to insure distribution of meeting related reports and other Industry products and dissemination of results throughout Government, Industry, and Academia;
- Supported the DDR&E, and Defense Systems Affordability Council activities for the Defense Manufacturing Conference; and
- Participated in other Industry Association and company conferences, workshops and symposia.

NCAT conducted studies, convened meetings as directed by the Contracting Officer, held focused workshops, and convened informal working groups of Industry, University and Government representatives whenever requested by the DDR&E. The emphasis of the efforts was usually on Technology for Affordability, but interactions with related areas were identified as needed in support of the DTAO in its role of providing engineering, scientific, and technical analysis for DDR&E.

As Secretariat to the Multi-Association Task Force NCAT scheduled and arranged Task Force meetings, and coordinated the activities of the various Task Teams, editing and publishing reports and other products of the Task Force, and maintained records of Task Force activities. Maintenance and support of the Task Force and its focused Teams was accomplished as was done as in earlier years:

- By identification of issues and preparation of draft agendas for Task Force meetings,
- Coordination with the Task Force Chair and other members,
- Arranging for expanded expertise and attendance at meetings,
- Preparing all meeting materials, minutes and/or proceedings of all meetings, and
- Following up on all action items, reporting status as requested, then making appropriate distribution of team results, findings and reports to Agencies and individuals outside the Task Team structure.

NCAT continued to expand the network and Task Force activities keeping the entire network informed through periodic written reports and personal visits. As new Task Force Teams, Industry Working Groups, Industry Steering Groups, and Committees were formed, NCAT solicited Professional Societies and Trade Associations to provide the appropriate staffing to address the issues to be considered and ensured integration into the Task Force structure.

Widespread awareness of Affordability technologies was essential to its acceptance, adoption, and effective utilization. NCAT continually improved on the development and maintenance of an awareness plan to facilitate the broad distribution of Task Force results. Two major symposia were planned for this period including an S&T Affordability Conference. These meetings presented the most significant actions and recommendations of the Task Force to a broad audience for information and feedback.

# **Summaries of Major Project, Organizational, and Program Activities Conducted by NCAT Under This Grant**

## **Overview**

The following sections contain summary descriptions of the most significant activities of the National Center for Advanced Technologies (NCAT) conducted during the period of this Office of Naval research (ONR) Grant. These activities are organized from a functional rather than a chronological view so that related projects, organizational, and program activities can be presented together for the sake of continuity. During many/most of the activities conducted by NCAT during the period covered by this Grant, the Multi-Association Industry Affordability Task Force (described in detail previously) was a major participant and contributor to these results.

This section presents a summary overview for most of the activities covered within. Only the major activities requested/funded under the Grant have been included. The frequent formal and informal interchanges between NCAT and its research analysts and study investigators and the various sponsoring organizations such as the Director of Defense Research and Engineering (DDR&E) resulted in a multitude of smaller research and support tasks, which were far too voluminous to be detailed in this Final Report.

## **Multi-Association Industry Affordability Task Force**

During the entire period of this Grant, NCAT acted as the secretariat for the Multi-Association Industry Affordability Task Force, which was created in 1993 to pursue studies in affordability and related areas for the DDR&E. The Industry Affordability Task Force is supported with "pro bono" resources from nine Industry Associations and Professional Societies as well as numerous private sector commercial and defense firms. The Task Force is a broad-based coalition of Industry leaders committed to maintaining the national security of the United States within the context of reduced spending and through collaborative activities.

The purpose of the Task Force is to develop, communicate, and advocate focused Industry input to the Department of Defense on a variety of issues and subjects. Volunteer Industry/Government teams operate together, under the coordination and facilitation of NCAT, to address areas of concern, especially those related to defense systems affordability, to both Government and Industry. Many of the activities

conducted under this Grant that are described in the following sections have been accomplished under the auspices of this Task Force and have been guided through its Executive Committee.

During the entire period covered by this Final Report, NCAT supported the activities of the Multi-Association Industry Affordability Task Force by acting as the Secretariat of the Task Force and sponsoring/facilitating the activities of the Task Force's Executive Committee and its associated standing and ad hoc Industry Teams and Working Groups. The Executive Committee of the Task Force met three to four times per year to exercise its oversight of the activities of the various standing action teams and ad hoc teams of the Task Force, receive reports from Team Chairpersons, receive presentations from various high-level Government executives, provide feedback to Government presenters and executives, etc. A representative sample of the agendas and the minutes of the meetings of the Executive Committee of the Task Force during the period covered by this Grant are provided in Appendix A of this Final Report.

The Task Force focused on Industry and Government actions that would accelerate the integration and use of commercial technologies to achieve national defense needs at affordable costs. It provided an "Industry Window" for Government Agencies, especially the Department of Defense and the Military Services, to receive direct feedback, unfiltered by any Industry advocacy/lobbying role—on any subject related to defense affordability (Science and Technology (S&T), open systems, ManTech, sustainment, etc.). The Task Force also created and facilitated Industry/Government team efforts in support of S&T Affordability and other issues.

## **Defense Manufacturing Council Support**

The Multi-Association Industry Task Force for Affordability was selected to act as the "Window to Industry" for the Defense Manufacturing Council (DMC). Note: The DMC was later renamed the Defense Systems Affordability Council (DSAC) and the two terms are used interchangeably in this Final Report, depending on the timeframe of interest. The DMC was organized as a high level Office of the Secretary of Defense (OSD) group chaired by the Principal Deputy Under Secretary of Defense (Acquisition and Technology) and comprising:

- Many of the senior staff of the Under Secretary of Defense (USD) for Acquisition & Technology (A&T) at the Deputy Under Secretary level,
- The three Military Service Acquisition Executives,
- The Director of Defense Research and Engineering,
- The Under Secretary of Defense (Comptroller), and
- The DoD's Director of Program Analysis and Evaluation.



The Task Force was invited to participate with the DMC in a review session of the DMC's strategic planning documents. In preparation for that review NCAT was requested to provide expanded Industry expertise to cover a broader range of commercial companies and Associations not usually involved in the defense acquisition arena. Attendees recruited for this special DMC review included the Chemical Manufacturers Association (CMA), the Information Technology Association of America (ITAA), the Information Technology Industry Council (ITI, formerly the Computer and Business Equipment Manufacturers Association, or CBEMA), the Armed Forces Communication and Electronics Association (AFCEA), and other several commercial and small business companies. A total of 26 Industry representatives at or above the Senior Vice President and Director level were able to participate in this activity. Read-ahead materials and the agenda were coordinated with the DMC Secretariat prior to their distribution to all of the participants.

The Defense Manufacturing Council/Industry Affordability Task Force Workshop started with briefings by each of the DMC Team Leaders, followed by discussion among the Industry contingent. The Industry team selected four from the group to become "spokesmen" to respond to each of the initiatives:

- John DeCaire, President, National Center for Manufacturing Sciences (NCMS) (*Pilots as Agents of Change*);
- John Ramsey, Vice President, Operations, Space & Strategic Missiles Sector, Lockheed Martin (*Process Maturation*);
- Jerry Ennis, Vice President, Prototype Center, McDonnell Douglas (*Cost as an Independent Variable*),
- Mike Robinson, Director of Business Development, Rockwell (*Cost Incentives*).

Each consolidated the views of the entire group and presented these views during the afternoon session.

The four topic areas were reviewed in open discussion. The proceedings of the meeting were published as an Industry "White Paper." The White Paper was then used as a jumping off point for many other symposia, policy papers, and methodologies throughout the term of this Grant.

While this activity was the start of joint efforts between the Multi-Association Industry Affordability Task Force and the Defense Manufacturing Council, several similar subsequent efforts over the next two years further developed and expanded an excellent working relationship between Industry and the Government participants. Some examples of the products resulting from this activity are described in the following sections of this Final Report.



## Characterization of Commercial Parts

The Multi-Use Team of the Industry Affordability Task Force completed the work involved in the characterization of commercial Integrated Circuits (ICs) for military use, expanding their efforts to include optics-manufacturing standards and the characterization of numerous passive electronics (capacitors, resistors, etc.) and optical components. The importance of these efforts to the DoD was greater than that of the Commercial ICs Project that had been the primary concern to the Principal Deputy Assistant Secretary of Defense for Dual Use Technology Policy and International Programs and his staff.

## S & T Affordability Workshops/Conferences

### First Affordability Conference/Workshop, October 1996

At the request of the DDR&E, NCAT, along with the DoD's newly-formed Science and Technology Affordability Task Force, arranged for a series of two-day workshops where S&T managers were briefed on examples of Integrated Product and Process Development (IPPD) use in technology demonstrations and also on affordability in major systems (e.g., the Boeing 777 program). The first in this series of recurring S&T Affordability Workshops was held in October of 1996. This type of workshop, typical of the kind of practicum that NCAT arranged frequently, complemented the NCAT activities on IPPD training and awareness. The agenda for this event is provided at Appendix B of this Final Report. Evaluations of the workshop by participants resulted in strong recommendations that future workshops be conducted (see Appendix C).

The October 1996 Affordability Conference/Workshop was held in Washington D.C. In addition to the plenary session presentations, four panel breakout workshop sessions were held. The Panel Sessions featured issue presentations, and then the entire participating audience was split into distinct groups or "workshops" to address each issue. Panel sessions focused primarily on S&T "best practices" in the Panel topic areas. Based on the case studies briefed in the plenary session and the panel participants' experience, each Panel addressed and reported on two or three key questions. At that time it was expected that the S&T Affordability Workshop would be held approximately every nine months to keep a focus on affordability in S&T and share best practices across the Department of Defense (DoD). Brief descriptions of the panel sessions held in this first Affordability Conference/Workshop follows:

- **Panel A: Integrated Product & Process Development/Integrated Product Teams (IPPD/IPT).** Government Co-chair: Bill Kessler. Industry Co-chair: Rose Gibson. Facilitator: Carol Fitzgerald.

The USD (A&T) policy letter on S&T Affordability (August 7, 1996) stated that, "other than senior management support, the single most indicative characteristic of programs that address affordability issues effectively is the employment of

IPPD/IPT.” This Panel’s focus was on the role of Integrated Product Teams (IPTs) and how they accomplish IPPD. The Panel’s charge was to define IPPD/IPT, summarize “case studies” relevant to the topic, and address the following issues:

- What are the “best practices” related to IPPD/IPT presented by the case studies?
- Based on participants’ experiences, what are other successful practices?
- What recommendations does the Panel have for considering additional “case studies” which are useful in understanding and implementing Integrated Product/Process Development and Integrated Product Teams?

- **Panel B: S&T Training & Education on Affordability.** *Government Co-chairs: Jerry Shumaker (AF) and Gene Baker (Army). Industry Co-chair: Jim Lang (McDonnell Douglas). Facilitator: Dr. Dan Schrage (Georgia Tech).*

Effective use of IPPD/IPT cannot be accomplished without training. The Panel discussed the role of IPPD education and training for the S&T community. Key to effective IPPD/IPT is the implementation of affordability concepts into the laboratory and culture change through the creation and delivery of relevant course materials. Questions addressed by this Panel included:

- What are the “best practices” related to IPPD training & education presented in the case studies?
- Based on participants’ experiences, what are other successful IPPD training and education practices?
- What recommendations does the Panel have for additional “case studies” that address training and education, and for exhibits/tools that support training and education objectives?

- **Panel C: S&T Transition to Acquisition.** *Government Co-chairs: Dr. Mike McGrath (DARPA) and John Gresham (Army). Industry Co-chair: Mike Robinson (North American). Facilitator: Dick Parisee (Consultant).*

S&T programs, particularly 6.3 advanced technology programs, must address affordability issues to the maximum extent possible to facilitate successful and cost effective transition to the appropriate phase of acquisition. This panel focused on the handoff of technology programs from S&T to acquisition. The panel addressed, and reported on the following topics:

- Based on the “best practices” and participants’ experiences, what examples of exit criteria are important to successful transition to acquisition?
- What are the “best practices” and organizational approaches for managing the handoff from the S&T community to the acquisition community?
- To implement these “best practices”, what issues will arise in funding, staffing, training, etc. for S&T programs that differ from current practice? What agenda

items in future workshops would be helpful to S&T managers? What recommendations should the DDR&E and Service S&T leaders consider?

- **Panel D: Affordability in the Defense Technology Area Plan (DTAP) & Technology Area Review and Assessment Process.** Government Co-chair: Dr. Lance Davis (ODDR&E). Industry Co-chair: Jim Williams (General Electric). Facilitator: Larry Kravitz (Consultant).

Senior Executives identified Advanced Technology Demonstrations (ATDs), Advanced Concept Technology Development (ACTDs), or other programs designated as "Affordability Programs" for input to the development of the annual DTAP and Joint Warfighting S&T Plan. Selections of these programs are reviewed at the Technology Area Review Assessments (TARAs) to provide feedback on the effectiveness by which programs address affordability, and to ensure compliance with the policies of the Under Secretary of Defense (Acquisition and Technology). This panel will focus on the following issues:

- How should TARAs be organized to address affordability?
- What aspects of affordability should be addressed by the DTAPs/TARAs?
- How many Affordability Programs should there be, and at what dollar value to promote affordability, yet not impinge upon technology creativity?

### **The Second Affordability Conference/Workshop, June 1997**

The format was essentially the same as the 1996 event, with plenary session discussions of major issues and topics followed by facilitated workshops in specific areas. The Conference Agenda is provided at Appendix D of this Final Report. The Panel Sessions of this conference focused primarily on how the process of affordability had been instituted. The issues were discussed and future actions defined in each of the four breakout panel sessions described below:

- **Panel A: Culture Change**

This Panel focused on how the process of affordability is being addressed in S&T programs. Overviews were provided by the Services on their implementation of the affordability process in S&T programs. Feedback was provided by the Affordability Task Force on affordability "best practices" and findings observed during its February/March 1997 review of the Affordability Pilot Programs by the S&T Affordability Task Force, and comparison to findings of the cognizant Technology Area Review and Assessment panels. A representative from the OSD Systems Engineering Office discussed how affordability, via the IPPD/IPT process, was implemented for major system acquisition programs in compliance with the policies of the Secretary of Defense and DoD Instruction 5000.1.

The Panel focused on the following issues:

- What aspects of affordability are being addressed by the S&T community?
- What barriers have been encountered in addressing affordability and what are potential solutions?
- What future actions need to be taken by the DDR&E and Service S&T leaders to improve affordability in S&T programs?

- **Panel B: Affordability Education and Training**

This Panel discussed what education/training strategies had been formulated to achieve the cultural change to implement affordability in the S&T community. It was noted that the key to effective IPPD/IPT was the implementation of affordability into the laboratory and culture change through the creation and delivery of relevant course materials. The Panel also discussed the role of IPPD education and training for the S&T community. Overviews of their implementation of education and training strategies in S&T programs were provided by the Military Services. An overview of current acquisition work force training was provided by the OSD Director for Acquisition Education & Training.

The Panel focused on the following issues:

- What elements or “best practices” were presented during the “learning for leaders” modules?
- Based on participants’ experiences, what were other successful IPPD training and education practices?
- What recommendations did the Panel have for additional “best practices” or courses that address training and education, and for exhibits/tools which support training and education objectives?

- **Panel C: Metrics/Measures of Effectiveness.**

This Panel discussed how S&T programs could use metrics to effectively assess affordability. A guest speaker presented the use of metrics and their applicability to affordability issues. The goal of the Panel was to identify metrics and tools that could be used to assess product and process affordability in S&T programs. The focus was on affordability metrics that were currently being used successfully within the Military Services and Industry. In particular, results of a recent survey conducted with Industry and Government program offices on how programs are assessing affordability were presented.

Panel discussion topics included:

- What types of affordability metrics were being used within Government or Industry?

- What methods have proved to be most successful in tracking measures of effectiveness?
- Based on participants' experiences, what were the best measures of effectiveness for affordability issues?
- What tools were currently available to the typical program office to help assess affordability?

• **Panel D: Transition.**

This Panel discussed how S&T programs could be transitioned more effectively. S&T programs, particularly 6.3 ATD programs, which must address affordability issues to the maximum extent possible and develop a transition strategy to facilitate successful and cost effective transition to the next phase of acquisition. The Panel focused on the handoff of technology programs from S&T to acquisition.

The Panel also addressed, and reported on the following topics:

- The results of an earlier (April 1996) "Transition to Customer Panel" meeting that assessed best practice models and current practice information..
- Based on the participants' experiences, what examples of exit criteria were considered to be important to help ensure successful transition to acquisition?
- What were considered to be the "best practices" and organizational approaches for managing the handoff from the S&T community to the acquisition community?
- To implement these "best practices," what issues will arise in funding, staffing, training, etc., for S&T programs that differ from current practice? What agenda items in future workshops would be helpful to S&T managers? What recommendations should DDR&E and Service S&T leaders consider?

**Third Affordability Conference October 1998**

A key objective in improving the focus on affordability is changing the S&T culture to emphasize a balanced approach between cost reduction and performance in advanced technology development programs. During 1996-1997 the DDR&E and NCAT hosted three workshops with Government S&T managers and Industry representatives to provide affordability awareness training. These initial sessions, attended by about 100-150 attendees, were structured to obtain first-hand feedback from S&T program managers who have responsibility for ATDs, ACTDs, and similar 6.2/6.3 S&T programs.

By comparison with the earlier (1996 and 1997) S&T Affordability Workshops/Conferences, the 1998 Affordability Conference was scheduled for 300 attendees from the S&T and acquisition community from both Industry and the DoD. Overall the purpose of the Conference was to improve affordability awareness among science and technology and acquisition personnel by exchanging views of ongoing

initiatives in S&T affordability, systems acquisition, and logistics reform. The Conference Agenda is provided at Appendix E of this Final Report.

The conference was organized to address a range of affordability perspectives, including

- Keynote presentations from DoD and Industry,
- “Hot Topic” presentations from each of the Military Services,
- Lessons learned from S&T program managers, and
- Panel sessions that addressed key issues of importance to the Defense Systems Affordability Council (including the process for transitioning technology to acquisition and a weapon systems program management perspective on technology utilization).

The Panel sessions on S&T Transition and Commercial Technology Transition and Affordability were particularly well received by the conference attendees. The Panels addressed such points as:

- Transitioning technology appears to occur with more ease in the private sector than it does in the Defense Industry. While there are numerous explanations for this apparent difference, there is no clear understanding of why commercial technology has a shorter cycle time, is generally more robust in transition to the user, and apparently transitions within prescribed cost parameters. Technology transfer in the defense sector, because of a number of complex interactions, is predictively more costly, obsolesces more quickly, and takes a long time to reach maturity. Issues covered included:
  - Can the private sector model be effectively used in defense or are there too many differences?
  - What would have to change to make the two more similar? What would the steps to change be?
  - Can the instigation of change come from the Government, the private sector or both?
- Government “Acquisition Reform,” defense downsizing, and Industry consolidation has been the climate in the defense establishment in the recent past. Defense budgets have been reduced. Defense companies and Government R&D organizations have been trimmed. However, there is increasing pressure to maintain a technologically superior force through other-than-traditional means. The Department has stated a reliance on commercial technology to ease the burden of cost of R&D, and the effective use of commercial technologies to make weapon systems more affordable. There has been a substantial realignment, and strategic partnering among defense companies. One result of this consolidation has been a greater vertical integration of conglomerate companies. While there has been a fair amount of cost savings reported in some defense systems, generally speaking, the cost of weapons systems continues to increase. Issues covered included:

- Are there any parallels in the private sector similar to the implosion of the Aerospace Defense Industry that might provide an insight into the impact of consolidation on technology transition?
- How does company expansion or sector expansion effect company technology transition decisions?
- What are the factors involved in deciding what technologies to advance and what technologies need further maturity?
- Do companies act wisely in their attempts to maximize the utility of technology?
- There are varying schools of thought on the measurement of technology transition. Typically any project whether pursued in the defense or private sector needs to be measured against some scale to determine whether to continue with the project or change to a different strategy. Programs in the DoD are measured against the criteria of Cost, Schedule and Quality. Private sector projects generally measure and are evaluated against the metric of Return on Investment, or Equity. Issues covered included:
  - What determines success with regard to transitioning technology?
  - Does Industry have metrics to determine the degree of success of transitioning technology? Is it solely profit/margin?
  - Who determines the technology or mix of technologies to pursue?
  - Who determines the level of maturity required going to market? Are these corporate decisions? Visionary decisions?
  - Are markets pursued or created?
- Current military systems are very old and getting older. However, the defense of the country will rely on these systems, some of which are over fifty years old, and programmed to stay in the inventory until the age of eighty or ninety. Merely keeping these systems in working order is a major challenge. Making these systems technologically superior to an existing threat or a yet unidentified foe will even be more challenging, and costly. For example, there are four generations of B-52 pilots that will potentially have flown the same type of aircraft. The problems associated with investment strategies for that fact alone have vast implications. Issues covered included:
  - Can the insertion of commercial technology assist in controlling the life cycle costs of the legacy systems that we must depend on for the next generation?
  - Can commercial technology insertion affect the logistics drivers of legacy systems with: Commercial fuels Technologies, Commercial Munitions Technologies, Commercial Maintenance Technologies, and/or Commercial Support Systems Technologies?



## **Process Maturity**

NCAT was asked by the Defense Manufacturing Council to provide insight into the discussion regarding the maturation of processes from an Industry perspective. Sixty days later NCAT delivered a White Paper, "An Approach to Process Maturity," outlining discussions of process maturity at the enterprise level and on the shop floor. The White Paper targeted the areas of what should be the DoD approach to process maturity in terms of:

- Requests for Proposals,
- Contract incentives,
- Source selection criteria, and
- Funding profiles.

It also generated further discussion and involvement between the Industry Affordability Task Force and the Department of Defense. It further resulted in a draft policy paper developed and refined under this Grant for possible use by the DoD. The policy paper was briefed to the Systems Engineering Steering Group under the Defense Manufacturing Council in February 1996 and it was forwarded to DoD officially in April 1996 (see Appendix F of this Final Report).

## **Quick Review of DODD 5000.1 and DODI 5000.2**

As a result of interactions with the DMC, NCAT was asked to make a quick review of the draft DoD 5000-series acquisition directive/instruction. NCAT held two meetings with DoD representatives and Industry, which resulted in a matrix being produced that compared DoD's policy letters and the new DoD Acquisition Directive and Instruction. This short term response to the request was followed by a secondary (long term) response, a paper titled Evolutionary Defense Acquisition (EDA) that suggested changing to a 3-5 year acquisition cycle while developing subsystem or systems to allow tactics and doctrine evaluation in field conditions. This activity would significantly change the acquisition cycle and simplify the process.

The EDA White Paper was put into the DoD Acquisition Desk Book and in January 1997 the Under Secretary of Defense for Acquisition & Technology signed out a policy memorandum encouraging Program Managers to use EDA as well as other non-traditional methods of acquisition. This is an excellent example of Industry/Government interaction on a topic of mutual interest—namely Acquisition Reform.

In addition to these examples, NCAT participated by providing:

- Industry representation in ad hoc groups on Value Engineering Change Proposals and Acquisition Reform Week II,



- Support for the Performance Based Business Environment activity, the Single Process Initiative discussions, and also discussions regarding the International Cooperative Opportunities Group, and
- Assistance to the development of a singular philosophy of Integrated Product Process Development, in which NCAT and its Multi-Association Industry Affordability Task Force played a major role.

## **Integrated Product/Process Development Activities**

There are several NCAT activities that were directly related to Affordability that were spun off and amplified as separate issues within the purview of this Grant. Some of these can be characterized as education and outreach activities to bring new practices and policies into widespread general use, particularly through cooperative efforts of Industry, Government, and Academia. NCAT played an important role in these activities as a facilitator of change. Part of the Integrated Process and Product Development (IPPD) products were created and produced under separate fixed price contracts, but it is appropriate to point out that a large portion of the research, report finalization, discussions, and promulgation of the methodology were concluded in more than one grant vehicle in addition to this Grant from ONR. This report addresses the activities in IPPD that merged the Affordability "Thrust 7" with the current Grant.

Early in 1993 IPPD was recognized as a key element of affordability. NCAT, along with the Georgia Institute for Technology (GIT) and the National Technological University (NTU) developed an educational video series on IPPD that ran for two hours each week from July to December 1993. GIT provided some of the theory and some useful examples. NCAT provided Industry leaders from companies in electronics, mechanical components, and system development, together with Government leaders representing the Army, Navy, Air Force, Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration (NASA), and Department of Commerce. NTU furnished the satellite links and recording facilities. This course provided Industry, Government laboratories, and Universities with examples of how IPPD was being used. The video series led to the idea of promoting a singular IPPD philosophy throughout DoD and extending its use to advanced technology demonstrations.

The NCAT team on IPPD also started the work on Capability Maturity Models (CMM) for Systems Engineering and IPPD. These seeds of Affordability were carried through to fruition in the 0557 Grant and were then expanded into various products (training tapes, CDs, training sessions) under various other contract vehicles to a number of different agencies.

NCAT, in cooperation with team members Georgia Tech and Texas Instruments, created a syllabus of instruction for IPPD. A course of instruction for Advanced Concept Technology Demonstrations, and Advanced Technology Demonstrations, at the Science and Technology spectral end of the acquisition process was then developed from the team outcome. Presentations of course content and planning were made to DoD. A three-day

pilot course was presented to Army ATD managers, and follow-on efforts for developmental and executive level programs were presented to the Army, Air Force, Navy, and OSD in separate activities. The Navy held two 3-day workshops on IPPD in late 1996, one 3-day workshop in January 1997, and an awareness briefing to senior executives within the Navy was presented in March 1997.

The DDR&E "seed funds" invested in cataloging Industry's methodology in IPPD has returned the investment with a singular approach to IPPD for mid-management and executive levels of the Services and OSD. In March 1997, an interactive video series for training in IPPD was completed for the Navy Acquisition Reform Office under separate contract. The leading section was a half hour description of the course and selected comments from DoD and Navy leaders. This tape was edited and distributed for use in Acquisition Reform Week II.

In conjunction with this training activity NCAT participated in a joint effort with *Defense Week*/King Communications to present a series of 2-day workshops (on a monthly basis) related to IPPD. For these meetings, *Defense Week* provided the venue and NCAT provided Industry speakers.

Training in IPPD was probably the most important aspect of changing the culture for a future work force. Organizations needed to embrace long term learning to understand how teaming and multidisciplinary efforts are incorporated into University and Community College curricula.

## **Dual -Use Technology**

In 1996, the Industry Affordability Task Force Executive Committee and Team Chairpersons of the Task Force met to review and discuss the "Dual Use" strategic plan prepared by the Office of the Secretary of Defense. This document was mailed out by NCAT to Industry Affordability Task Force members for review. Each member of the Task Force, whether team member or Executive Committee member, reviewed the documents and prepared for a group discussion. The general expertise of the Task Force was again expanded as in the past by the addition of other ad hoc members solicited by NCAT to participate in this special event of the Task Force. NCAT then arranged a one-day Executive Committee meeting to address the issues. The Deputy Assistant Secretary of Defense for Dual-Use Technology Policy and International Programs and his staff were in attendance to receive comments and suggestions the Task Force offered at the Executive Committee meeting.

Industry participation in this "Dual Use" review included a broader perspective than was normally involved in Task Force activities. NCAT then hosted a Workshop for discussing the Fiscal Year 1997 Dual-Use Program's Commercial Operations & Support Savings Initiative (COSSI). Government and Industry representatives discussed the issues in some detail and NCAT provided an Industry White Paper on COSSI prior to the bidders' meeting in mid-February 1997.

## Defense Manufacturing Conferences

NCAT's Industry Affordability Task Force Teams had participated in presentations in the plenary and breakout sessions of the Defense Manufacturing Conferences through the 1990s. During the period of this Grant the NCAT involvement in the orchestration of the Defense Manufacturing Conference grew as the years progressed to that of the role of Industry presence facilitator and Defense Manufacturing Conference program designer. NCAT recruited and arranged both Government and Industry speakers for the plenary sessions and breakout sessions on numerous ManTech related and other manufacturing topics.

As part of the Defense Manufacturing Conference agenda, the Multi-Association Industry Affordability Task Force initially cosponsored an Awards Luncheon where various awards were presented to individuals and teams of manufacturing companies to recognize superior achievement. The first award was presented to an individual as a "Distinguished Colleague Award." This first award was presented to the Honorable R. Noel Longuemare. Among the follow-on awardees in subsequent years was Mr. Bill Andahazy for his support of Manufacturing Technology while he was a Professional Staff Member on the staff of the U.S House of Representatives National Security Committee (formerly and later the House Armed Services Committee).

Because of NCAT's intervention in the process the award evolved to one that took on national significance in recognizing manufacturing excellence. The format was modified to insure that each of the Associations that participated in the Affordability Task Force had some input into the selection of the award recipient. Each Industry Association and Professional Society co-sponsored this event with NCAT in turn. The nomination, selection, and presentation of the Defense Manufacturing Excellence Award became a national recognition for a person who displayed excellence in the field of defense manufacturing during the calendar year prior to the award. Each year a different Industry Association or Professional Society chaired the nomination/selection committee that managed the process.

Nominees for the Defense Manufacturing Excellence Award were submitted from a wide national field. The selection of a candidate nominee for the Award was made by vote from the Association's/Society's membership. The Associations were all represented on the nominating committee and voted on the nominees submitted from all Industry sectors, with each Association/Society having one vote. NCAT acted as the secretariat and orchestrator for the award process. By the end of the term of this Grant over 800 people per year attended the Awards Luncheon held during the Defense Manufacturing Conference. The Award has since grown to include manufacturing teams, companies, and program offices, in addition to individuals who stand out in the field of manufacturing for the year previous to the award.

## **Process Effectiveness**

Again, in support of a Defense Manufacturing Council request addressed to the Industry Affordability Task Force to review current defense processes, a multi-disciplined Task Team from Industry and Government accomplished a root cause analysis of "problem" procurements. The results indicated that a major cause of DoD acquisition problems was the imbalance between product/system goals and the maturity of engineering and manufacturing processes used to reach those goals (e.g., stable and capable processes are needed to support design, production, operational use, and logistics support for DoD products and systems).

The Defense Industry acquisition environment seemed to favor rapid, low-cost prototyping and development without a balanced emphasis on the follow-on stages of production. Suggestions were made that could assist in the evaluation of the maturity of processes incorporated in systems acquisition. Process maturity models such as those developed by the Software Engineering Institute (e.g., Software Development, System Engineering, and IPPD), along with Quality Models such as ISO-9000 or ANSI/ASQC Q90, and manufacturing "models" such as the Air Force Manufacturing Development Guide and Maturity Matrix, were pointed to as possible tools to assist in the judging of process maturity (see Appendix G of this Final Report).

## **Evolutionary Defense Acquisition**

Resulting from the previous years' activities in simplified contracting, a Task Force Team operating within the structure of the Task Force refined the concepts that dealt with the impediments to Government/Industry teamwork. They created a pro-active roadmap, or trust-model, under which Government and Industry could cooperate and collaborate on the implementation of the new DoD-5000 series of acquisition policy regulations/directives/instructions. The main thrusts of this roadmap were to (1) shorten the current excessively long defense systems acquisition process, and (2) facilitate a major improvement in cycle time.

NCAT published and briefed the Evolutionary Defense Acquisition White Paper (see Appendix H of this Final Report) to various levels of Government agencies a "strawman" approach which could both represent a roadmap for Government-Industry teamwork and permit a reduction of the 10-15 year system development process to a length of about 3-5 years. By combining proven practices from successful military and commercial programs with team-based execution of the Cost-as-An-Independent-Variable/Overarching Integrated Product Team (CAIV/OIPT) principles, the approach could replace the traditional long, multi-phase process with a much shorter, less expensive weapon systems cycle. It required however that Industry and the Office of the Secretary of Defense to work closely together to implement the details of this approach by creating new acquisition policy.

The new process was called “Evolutionary Defense Acquisition,” or EDA. The concept preserved and enhanced the CAIV principles and the necessary teamwork outlined in earlier NCAT works, and suggested the replacement of the current multi-phase acquisition cycle with a much shorter process. To provide a basis for full examination of EDA, implementation specifics were also provided along with some key lessons-learned programs from which information was taken to formulate the process. Although there were actual programs used as models to form the EDA concept, NCAT recommended that the new approach should also be “piloted” on a few programs for validation.

The Department of Defense did in fact eventually adopt this concept. The current preferred acquisition approach for DoD (as of the date of this Report) is “Evolutionary Acquisition” (EA). DoD’s Evolutionary Acquisition approach is generally acknowledged to have originated with this EDA White Paper from the Multi-Association Industry Affordability Task Force—a tribute to all the participants in this effort. See Appendix H of this Final Report for the complete NCAT EDA White Paper.

## **International Cooperative Agreements**

At the request of Dr. Spiros Pallas, Office of the Under Secretary of Defense (Acquisition and Technology), an ad hoc team of the Industry Affordability Task Force, under the chairmanship of Mr. Mike Robinson, Rockwell North American, met to discuss potential participation in an initiative dealing with International Cooperative Opportunities. Seven companies (ranging in product lines from ground vehicles to avionics, electronics, engines, and airframes) were represented. All agreed that the end result of this get-together would be the preparation of a White Paper to be coordinated with the balance of the Task Force prior to delivery to OSD.

The International Cooperative Opportunities concept, initiated by the Under Secretary of Defense (Acquisition and Technology), was an attempt to facilitate jointly developed requirements with other nations, with European Allied nations at the outset, and potentially globally. The concept was derived from a U.S. study completed in the Spring of 1996, which indicated that a joint requirements activity between the allied nations was “meager.” While there was cooperation between Governments in international armaments activities, and there were some company-to-company activities, sharing of requirements internationally was not very well formulated.

The review by Mr. Robinson’s Task Force Team highlighted some concern within U.S. Industry that the Europeans might gain a significant advantage over their U.S. counterparts if the initiative were pursued without a closer partnership between U.S. Industry and the U.S. Government. It was perceived that the initiative could be a unilateral opening of the U.S. market. Because of workshops such as this, facilitated and orchestrated by the NCAT Industry Task Force, potential situations that could be detrimental to the U.S. Defense Industry were averted. (See the complete White Paper at Appendix I of this Final Report)

## **COSSI Perspectives**

The Dual Use Applications Program (DUAP) Office initiated a novel program to attempt to help reduce the operations and support costs of existing, fielded weapon systems. The program, entitled the Commercial Operations and Support Savings Initiative, was formally launched with a January 15th, 1997 announcement and solicitation to the private sector to respond with proposals for evaluation and subsequent award. The COSSI program manager requested NCAT to gather and facilitate an Industry Team under the auspices of the Affordability Task Force to assist in the formulation of the mechanics of the program.

The COSSI program was designed to develop and test a method to reduce operations and support costs of fielded military systems by inserting commercial technologies (products and processes). The concept underlying this initiative presumed the use of proven commercial products and processes which require less development, special equipment, and test costs and which will reduce the cost of operating and supporting the overall fielded system. It also supposed that the capability, reliability, and efficiency of the system would, at a minimum, remain the same.

On balance, the program was considered by Industry to be innovative. It attempted to bring a fresh, new perspective to the world of defense acquisition. With the reduction of operations and support (O&S) costs being the primary motive, the traditional DoD acquisition decision processes will be changed by the COSSI program. Based principally on the typical commercial activity of the "business case," the initiative shifted Profit & Loss risk directly to the company. On the other hand, the concept of "product value pricing" versus "cost based" activity, shifted acquisition decision risk directly to the Government acquirer. The decision to buy goods and services would now be based on price and best value alone. These ideas, new to defense procurement, are imbedded in other innovations and trial programmatic ideas, which (if acceptable to both the defense community and the Industry) had the potential to change the way the traditional defense acquisition system operates

Discussions were held under NCAT sponsorship at NCAT's offices with numerous Industry representatives (who were then participating in the Multi-Association Industry Affordability Task Force) prior to the issuance of the formal COSSI broad area announcement and solicitation, helped to formulate the concept of the initiative.

The Industry group indicated that there were a number of new ideas embedded in the COSSI program and they received close scrutiny and discussion. Further Industry examination, continued review and comment, and certainly full and open participation between Government and Industry would be necessary as the program evolved. These new ideas warranted close tracking by Industry and Government to insure that the successes are institutionalized and the pitfalls and "blind alleys" were catalogued and avoided in any future iterations of the program.



The Industry participants noted that while the COSSI effort was addressing the shorter term issue of the DUAP program, there was a longer term component that should be infused into the DoD S&T program. The NCAT Multi-Association Industry Affordability Task Force, which provided the input for this White Paper, indicated it was ready and willing to continue the dialogue for the S&T portion of the program and to address any future activities in the COSSI program that might catalogue lessons learned or pitfalls to be avoided.

The Industry White Paper that was provided to the COSSI program managers as a result of this activity is provided at Appendix J of this Final Report.

## **Sustainment**

In an effort to get the DoD to consider bold actions be in a serious attempt to significantly reduce growing weapon system sustainment costs and thus shift funds to new procurement and recognizing the necessity for providing an Industry viewpoint to the issue of sustaining the military forces systems in a business-like way, the National Center for Advanced Technologies chartered a team under the auspices of the Multi-Association Industry Affordability Task Force to examine the situation and report recommendations. This activity took place from 1997-1998.

The Sustainment Team was formed with Industry experts from within the resources of the Task Force. Team members were selected based upon experience in commercial or DoD sustainment processes, and represented a broad section of Industry. The objective of the team was to focus particularly on the "Support" issues incorporated in "Operation & Support" cost. Based upon previous team results, this team would seek to identify potential solutions, assist in the identification of resources needed to improve sustainment technologies, and help to identify sustainment technologies as they apply to procurement of new systems.

The Sustainment Team created a draft charter which was presented to and approved by the Executive Committee of the Task Force. In general terms the Team was to conduct a thorough examination of weapons systems' sustainment with the aim of identifying barriers, cost drivers, and issues confronting Industry in their attempts to reduce sustainment costs, then extrapolate this information to the situation confronting the Department of Defense today and present the findings as an independent, unsolicited Industry review of the sustainment issue. In addition, the Task Force Executive Committee sought information which could possibly provide methods for reducing the growing cost and effort of sustainability by identifying high cost drivers of major weapons systems, determine what portion of those costs could be effected, and identify the barriers or innovative solutions for reducing or eliminating the high cost area. The final report of this analysis effort was made available to the decision-makers in the Department of Defense in the form of plans and recommendations (see Appendix K of this Final Report).

The Team proposed a process that would transition DoD from its current "Vicious Cycle," where deferred modernization meant that operations and support activities consume increasing amounts of scarce defense resources and thus prevents modernization, to a more "Vital Cycle" that would reduce the sustainment costs of legacy systems and provide for modernization of weapons systems. The recommendations of the Team leaned heavily on using commercial practices and suggested improvements in reliability/maintainability through Industry-DoD partnering. In perspective, the core competencies of Industry and DoD are different. DoD has a long history of maintaining systems, albeit not at the lowest cost or cycle time. The private sector, however, has built a core competency in both maintaining and improving system components because of different incentives: reducing the costs of warranties and the high cost of defective products.

Generally, the recommended process called for:

- Changing the concept of maintenance from three levels to two levels, except by waiver, and utilizing commercial-depot competition for lowest cost and time.
- Depleting current inventories of low-reliability spares while ordering improved components.
- Reducing sustainment costs by selectively identifying high-cost and low reliability components for industry improvement through total ownership responsibility.
- Applying commercial business decision filters to the support mechanisms of legacy systems.

There was then (and there is now) no question regarding the importance of the goal of shortening of the cycle time of defense acquisition. Considering the nominal twenty-year cycle that is prevalent in defense acquisition, a 50% reduction (ten years) is certainly an improvement. However, even greater reductions are possible. The Evolutionary Defense Acquisition process models the development to initial operational capability of a Major System in 5 years, including fielding and user operation evaluation of battle group size production prototype lots. For new systems the compressed acquisition cycle takes into account the corrections needed for their sustainment. The NCAT Sustainment White Paper dealt principally with the sustainment issues for legacy defense weapon systems and was complementary to the EDA concept (see Appendix H of this Final Report), and was also in concert with the DSAC then-current goals of addressing a revolutionary approach to solving the sustainment problem by re-engineering the logistic systems.

The Sustainment study illustrated how these revolutionary ideas might work within the DoD system. Actual examples of how these ideas were (and still are) working for both Industry and government were provided. The success of various Industry initiatives in communications systems, propulsion systems, and other type-systems were illustrated. Implementation of Direct Vendor Delivery and Contractor Logistics Support concepts were also discussed in the Report.



Notwithstanding the revolutionary ideas espoused in the NCAT Team's Sustainment paper, there remained many major barriers that must be overcome before any progress is to be made. It will take bold decisiveness to start the action and non-parochial decision making to follow through. The bottom line to all of the ideas presented in the study was this: the warfighter must not be put at risk but rather should be the beneficial recipient of any change in method or policy that accomplishes this paradigm shift. The Sustainment Team noted the adoption and execution of commercial business practices was an outstanding objective, but would require major efforts to develop partnership and trust between Industry and Government.

## **Spin-On Technologies**

During the latter part of the summer of 1997, NCAT, at the request of the Dual Use Program Office in the Office of the Secretary of Defense, sponsored a series of "one-on-one" interviews/conversations between Industry and Government executives to identify some parameters for discussion into issues revolving around the concept and practice of "spinning on" commercial technologies into defense systems (as opposed to the more commonly used "spinning off" of technologies from the defense sector to the commercial sectors). There was an emphasis on pursuing commercial technologies because it was perceived that technological solutions to problems reach the marketplace faster in the private sector than do product solutions in the defense acquisition environment. One of the premises in this thought process was, "more resources are spent by the private sector for research and development than in defense." It was thought that if the DoD had the ability to leverage this source of technology it could be a potentially beneficial source of technologies and products that could be leveraged to satisfy defense requirements.

Distilling the "one-on-one" interviews provided an increased clarity into what one could reasonably expect when delving further into the idea of accessing technology from non-traditional commercial sources. The material gained from the summer sessions was used as a basis for further information gathering in a planned series of roundtable workshops that were held in the following fall.

Two Industry-Government Workshops, in addition to the interviews (all hosted by NCAT), were held. These Workshops were attended by senior Government and Industry managers and executives. Two viewpoints were examined, a "prime-centric" view; that is, the Industry component of the Workshop Team represented the large U.S. companies generally referred to as "prime contractors." A second "tiered view" Industry/Government Workshop was held that focused primarily on the companies that generally supported other companies in the pursuit of a product to market by providing material, manufacturing, or management technologies and services.

The NCAT "Spin-on Technologies" Report (at Appendix L of this Grant Final Report) combines the workshops and provides an insight into interesting phenomena that were prevalent in the marketplace. The understanding of these mechanics was very helpful to the DoD in formulating policy.

# **Manufacturing Technology Roundtables**

## **Concept and Purpose**

Roundtable sessions started in the mid-1990s, when the sponsors of the Military Services' Manufacturing Technology (ManTech) Programs, the Defense Advanced Research Projects Agency's Director of Manufacturing, and the Office of the Director of Defense Research and Engineering (ODDR&E) joined with the Chairpersons of the Manufacturing Committees of the eight Industry Associations involved in NCAT's Multi-Association Affordability Task Force, forming the Joint Defense Manufacturing Group (JDMG). The purpose of the JDMG group was to share views on manufacturing technology issues that affected the overall defense acquisition program. Roundtable sessions continued to address current issues within the Defense ManTech and other programs over the period of this Grant.

## **Execution and Follow-on**

Because of the initial success and acceptance of the JDMG concept by all participants, several Roundtable meetings were held under the auspices of this Grant. The Roundtable sessions were met principally at the Defense Manufacturing Conference for two years, and at a separate series of Roundtable Sessions in Washington D.C. which included representatives from the DoD Centers of Excellence and Professional Staff Members from the House and Senate Appropriations and Defense Authorizations Committees. The Roundtables addressed a number of critical issues. Some of these knotty issues would have never reached a successful conclusion if it were not due to the efforts of the Roundtable sessions. Most notable of the Roundtables' "successful issue resolutions" was the reduction of Congressional ManTech appropriation/authorization earmarks from 85 percent of the total ManTech appropriations in Fiscal Year 1994 to just 19 percent in Fiscal Year 1997 which was generally understood by all participants to be a direct result of the 1996 Roundtable session.

Another series of Roundtable events dealt with the issue of DoD's Manufacturing Technology "Centers of Excellence." NCAT hosted, or caused to be hosted by other participants, a series of Roundtable meetings that attempted to resolve budget and programmatic issues in the DoD's manufacturing technology program. For the first time, the Centers of Excellence were brought into the broader discussion of their role in the overall Manufacturing Science and Technology (MS&T) planning process. The three sessions were designed to display the extent of program "Jointness" to select Congressional staff members who were involved in ManTech authorizations and appropriations matters.

Orchestrating this series of meetings spanned a six month period. While the accomplishments were many, the most significant was the fact that Industry representatives, Congressional staff personnel, Military Service sponsors of ManTech programs, OSD directors of S&T, and officials of the MS&T Centers of Excellence were

able to share ideas and concerns at the same table and at the same time for the first time in the history of the DoD ManTech program. While all the goals were not attained, a successful plan for the next year's programmatic activities was initiated and the sessions provided a common framework for discussing issues influencing the budget for defense manufacturing technology research and development.

Some examples of other issues addressed during some of the many Roundtable sessions follow in this narrative. A representative example of a fuller examination of some these issues and their discussions, along with the agendas, list of participants, and proceedings are provided in Appendix M of this Report.

### **Representative Roundtable Issues**

ManTech Issues Discussed at the Various Roundtables included:

- Issue: Should ManTech's emphasis be on developing dual-use/commercial products (which is more closely aligned with a cost-sharing policy), addressing defense driven requirements, or some combination of both?
- Issue: Given the reduced funding base available for the DoD's ManTech programs, are the ManTech investments being spread too thin by continuing to attack the entire spectrum of weapon system life cycle manufacturing issues? Should the limited funds be devoted only to solving long-range precursor manufacturing process issues? Or, (exactly opposite) should the limited funds that are likely to become available be applied only to the application of near-term production and sustainment process issues?
- Issue: Should the DoD continue to sustain manufacturing Centers of Excellence? Should the Centers have a finite life? Should the DoD and Military Services consider separating the Center programs and portion of the program which has contracts directly with Industry into separate program elements (PE)?
- Issue: How can the ManTech funding disconnect between Congress, the Services, and OSD be reconciled? What is the right funding level, and in what PE, or PEs should the funding reside?
- Issue: Should Service ManTech programs be adjusted to focus limited funds on manufacturing-driven pilot demonstration advanced technology development programs?
- Issue: How can the Tri-Service/Multi-Agency Team be rechartered and reinvigorated in order to gain the right level of DoD management attention and oversight needed to guide the program?
- Issue: Should the Office of the Secretary of Defense revisit the current ManTech cost sharing policy and statutory requirements with Congress? If so, what should be the proposal (e.g., no cost sharing requirement, flexible cost sharing, etc.)?

This last (cost sharing) issue received special attention because Congress had required that 25 percent of the available ManTech funds each fiscal year be used for ManTech contract awards with at least an Industry-to-Government funding ratio of 2-to-1 for cost sharing. This was because cost sharing for ManTech was thought by Congress to be appropriate where risk had been lowered or where there was a potential commercial market application that warranted a contractor investment in conjunction with Government funding.

## **Technology Area Review & Assessment**

In 1996 NCAT was requested to provide a team of Industry participants to augment the Government reviewers taking part in the DoD's ManTech Technology Area Review and Assessment (TARA). This ManTech TARA, whose members consisted mainly of Industry evaluators, found that a number of the ManTech projects addressed only marginal cost drivers. The TARA team gave subjective ratings to DoD's manufacturing programs after reviewing presentations made by technology project leaders and program managers. Ratings were given to various projects such as pilot demonstration ATDs that had specific goals, metrics, implementation plans, critical mass, and pervasive impact. This was a departure from the historical investment portfolio for ManTech, where limited funds had typically been allocated across multiple weapon system programs and customers—satisfying many customers' desire for a piece of the action, perhaps at the expense of being able to have a major impact.

NCAT continued to support these TARAs in subsequent years (1997 and 1998) in a similar fashion under this Grant as well as follow-on Grants (TARAs are now conducted every two years). For follow-on TARAs NCAT has nominated distinguished Industry participants with a strong manufacturing background and expertise and has arranged, once they were accepted by the relevant DoD officials, their preparation for and attendance at the TARAs. DoD ManTech program officials have repeatedly indicated their satisfaction with and appreciation for NCAT's efforts and Industry's participation in these ManTech TARAs.

## **Summary**

The following is a summary of many of the major products delivered and events held during the term of this grant in support of the Affordability, Acquisition Reform, and Manufacturing Science and Technology activities of the Department of Defense and the Military Services.

- Three DMC/Industry Affordability Conferences/Workshops (1996-1998)\*
  - October 1996 S & T Affordability Conference/Workshop\*
  - Critique Results and Proceedings of the S&T Affordability Workshop\*
  - June 1997 S & T Affordability Conference/Workshop\*

- October 1998 S & T Affordability Conference/Workshop\*
- Process Effectiveness Assessment White Paper\*
- Industry Review of the Revised Draft DoD Directive 5000.1 and DoD Instruction 5000.2 (1996)
- Summary Report and Recommendations for Accelerating the Use of Commercial Integrated Circuits in Military Systems
- International Cooperative Opportunities White Paper (1996)\*
- Process Maturity White Paper (1996)\*
- Process Effectiveness Recommendations to DoD (1996)\*
- Evolutionary Defense Acquisition White Paper (1996)\*
- DMC Industry-Government Roundtables and Other Roundtables\*
- “Spin-On” Technologies for Affordability (1998)\*
- NCAT Industry White Paper—Industry Perspective of the Commercial Operations and Support Savings Initiative (COSSI), DoD Dual Use Applications Program (1997)\*
- Meetings of the NCAT Multi-Association Industry Affordability Task Force and Task Teams (1996-1999)\*
- NCAT Sustainment Report (1998)\*
- Defense Manufacturing Excellence Award (1996-1999)

(\*) Indicates the document(s) describing all or a significant portion of the activity or event (Proceedings, Final Report, White Paper, Agenda, etc.) may be found within the Appendices to this Final Report. Otherwise the description may be found in the main body of this Final Report.

## **Appendix A**

### **Minutes from Representative Meetings of the NCAT Industry Affordability Task Force**

*September 16, 1996*

*April 16 1998*

*July 30, 1998*

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## **Minutes of the Industry Affordability Task Force**

National Center for Advanced Technologies Offices  
Washington, DC

September 16, 1996

The Executive Committee met this date from 9:00 am to 13:00 pm. The main purpose of the meeting was to continue discussions on the issues of cost sharing and set asides for the ManTech program. In addition, normal business activities of the Task Force were considered and discussed. Actions were assigned as necessary as a result of the discussions. Task Force Team Chairmen attended along with representatives of the associations that collaborate with Task Force activities.

Mr. Sinnett, Executive Committee Chairman, opened the meeting.

### **Presentation by Mr. Bob Rice (AF/WLMT) ManTech Program**

Mr. Bob Rice ManTech presented a briefing on the requirements planning process of the JDL MS&T program. His briefing covered the planning process of the Air Force ManTech program, with an elaboration on the JDL ManTech Panel joint planning process. Mr. Rice went through the process of putting the requirements together, the review process and the issues database. Rice presented the top level planning/guidance strategy, the MT selection criteria, and the schedule of events for the FY98-00 buy. He then went into more depth on how the services planning process dovetails with the joint planning process. A copy of the expanded briefing is attached. The discussions during his presentation revolved around the JDL MS&T database and the potential for sharing the issues with Industry. The current policy of JDL is to not share any of the information with agencies outside the JDL. Additional discussion revolved around the potential of progressing with another roundtable session with the professional staff of the legislators involved to indicate a return to solidarity.

### **Presentation by Dr. John DeCaire, NCMS**

Dr. DeCaire presented an NCMS capabilities briefing. The intention of this presentation was to bring everyone to the same level of understanding of the Center's capabilities and the mechanism by which it conducts business. The range of issues discussed had to do principally with the groups desire to recoup the generally agreed upon position during last year's roundtable sessions. The following summary of the discussion indicates consensus of the group:

Noted from floor was the need to disseminate information about the capabilities of the NCMS more widely throughout the Industry. This notion was articulated as a perception



by the group that although new manufacturing technologies advanced by NCMS could fulfill many of the needs of Industry, information about current successes was sparse. A greater knowledge of NCMS's activities and successes throughout the community might be the key to increased company participation and increased operating resources for the center.

The cost sharing issue was brought up. Dr. DeCaire stated the NCMS is not actively pushing implementation of the 25% two-to-one cost share language at this time. He also mentioned that NCMS staff had met with Congressional staff and stated their intention to work closely with the defense community for the benefit of the entire ManTech program. He added that NCMS would actively work with the defense community, hill staff, Industry, and the department to achieve a stronger, larger ManTech program that would accommodate cost sharing without damage to any exiting projects or the program as a whole. All agreed that the appropriate ManTech program structure was built on requirements and competed for resources within the TOA of the department on an equal footing with all other programs.

The discussion period following the presentations revolved around the best actions that the Task Force constituents could take to remedy the situation and get the program "on track" Recommendations following from the discussions are summarized as:

1. There is a need to increase "marketing" activities of NCMS, with particular attention given to getting the word out to companies not normally involved with the operations of NCMS. The anticipated result of this activity would bring more recognition for NCMS, potential of greater revenue through increased participation, and less reliance on a "subsidy based" program.
2. There is a need for Industry to share in the JDL MS&T Issue Data Base. Recognizing that the data base still requires refining, and budgetary data need not be distributed, the MS&T issues data base is still an excellent source for identifying areas that require technological solutions which can be provided by the efforts of NCMS and other business entities.
3. There is a need for the ManTech community to devote more attention to Industry generated requirements. These requirements, based on the gaps companies working on defense needs have identified, should have a vehicle to allow entry into the requirements process. This process should accommodate requirements inputs from the private sector to compete for acceptance within the ManTech program, so that there would not be non-defense solutions to defense essential requirements. Industry requirements would have to pass the test of improving Affordability of military requirements.
4. There is a need to bring the Roundtable constituents together once again to articulate the positions of the Industry, NCMS, and the other centers; gain acceptance with the organizations within OSD that manage the program, and gain approval of the congressional committees that provide the resources for MS&T.

## **Presentation by Mr. Bob O'Donohue, OSD**

Mr. O'Donohue presented an update of the activities of the Defense Manufacturing Council, reviewing the strategy, objectives and accomplishments of the DMC overall, and progress made since the last update given last spring. Mr. O'Donohue also touched on areas progress has been made and some of the future directions that the council is taking: workforce education, Cost as an Independent Variable (CAIV), Performance Based Business Environment, and Open Systems.

One of the items of interest in Mr. O'Donohue's presentation was a request for a feed back "report card" (see last two pages of Mr. O'Donohue's presentation.)

## **Team Chair Update**

### Mr. Robinson, Simplified Contracting

The Evolutionary Defense Acquisition model is now part of the Defense Acquisition Deskbook, and a memorandum has been prepared for Dr. Kaminski which will endorse the use of non-traditional approaches to defense acquisition, such as the evolutionary or incremental acquisition process of the NCAT Evolutionary Defense Acquisition (EDA).

## **New Business**

### S&T Affordability Workshop

The Task Force will jointly sponsor and participate in a workshop on October 2-3 in Washington D.C.

### Defense Manufacturing Award

Mr. Lewandowski presentation:

Ballots for nominating candidates for the award have been distributed throughout the Industry Associations. The nominating committee will focus down to no more than three candidates. The award will be then made based on the trade association and professional societies voting on the nominating committee's recommendations. The presidents of the associations would then vote to endorse the award recipient.

- Next meeting of the Executive Committee and the Team Chairmen will be concurrent with the S&T Affordability Conference—October 2-3 1996 in Washington D.C.

Meeting adjourned at 13:30 p.m.

**Minutes of the**  
**Industry Affordability Task Force**

National Center for Advanced Technologies Offices  
Washington, DC

April 16, 1998

The Executive Committee met this date from 9:00 am to 3:30 pm. The main purpose of the meeting was to inform the executive committee on current activities regarding Task Force concerns, Task Force Teams operations and conduct discussions with OSD leaders on various topics (See Agenda). In addition, normal business activities of the Task Force were considered and discussed. Actions were assigned as necessary as a result of the discussions. Task Force Team Chairmen attended along with representatives of the associations that collaborate with Task Force activities.

Mr. Sinnett, Executive Committee Chairman, opened the meeting.

**Presentation by Mr. Bill Lewandowski, V. P. Supplier Management of AIA**

Mr. Lewandowski presented the makeup, charter, and direction of the newly formed Aerospace industries Association Supplier Management Council. During his briefing he explained the organizational structure, the charter, the groups assigned and their future direction to resolve issues, member companies, and how the membership was indexed to products.

Upon questioning, he explained the definition of "Supplier" being used, since some primes are suppliers for other primes and smaller companies. The definition does not imply small company, but did require manufacture of a product. Distributors are not allowed, and are not part of the council.

Workshops have been conducted and future workshops are planned. Please refer to the presentation materials for a listing under each of four working groups.

**Presentation by Dr. Lance Davis, Acting Director, Defense Research & Engineering**

Dr. Davis presented the outcome of the Technology Area Review and Assessment recently accomplished on the Manufacturing Technology program and current activities of the S&T Affordability Task Force the government counterpart of the Industry Task Force for Affordability. The S&T Affordability Task Force is part of the Defense Systems Affordability Council (DSAC) structure—nee Defense Manufacturing Council (DMC). Dr. Davis explained how the groups fit within the DSAC.

In his presentation Dr. Davis noted that the transition plans of each of the manufacturing technology programs were being evaluated much more than in the past. Transitioning technology into major weapon system programs is not as institutionalized as government leaders would like. In the ensuing discussion of transition, the participants generally agreed that they viewed transition as a window: technology should be transitioned in this window of opportunity. Currently technology transition happens, but often misses the window of effective transition, or is not used at all because of manufacturing problems. All saw this as the reason to better explain this to raise importance in the S&T workforce.

In the discussion that followed Dr. Davis recommended that program managers, including the ManTech Project Managers needed more training in integrated Product/Process Development (IPPD). Industry members of the executive committee agreed noting that a similar need for education and training was recognized by the companies doing business in defense. Dr. Davis explained his policy that the government workforce needs a yet undetermined number of hours of affordability training. In the ensuing discussion metrics were discussed. Training as a metric overlapped with the conversation that was indicating the need for training throughout the work force. The potential for a training metric was discussed. Measure this as one metric: XX percent of the workforce attains YY hours of training. It was suggested that 40 hours annually is a current measure that the companies strive for.

Further discussion raised the issue that it was hard to get attention for training and affordability of the S&T community because it appeared to outsiders that the S&T community's perception of Affordability and attendant training was third or fourth order of importance. Compounding this barrier was the fact that most issues in defense today are driven by the need to save resources in operations and support (O&S). The discussion revolved around the perception that it was generally very difficult to get resources to be applied to affordability programs if there were no direct link to O&S projects and if savings in O&S were not seen immediately.

#### **Presentation by Stephen Olsen, Simulation Based Acquisition Team Chairman**

Mr. Olsen explained the concept of simulation based acquisition (SBA), and then reported of the progress of the team to date. His presentation generated a lot of discussion: some of the highlights were:

The SBA program was concentrating on the developers of models, not just the primes or other big companies, but will change to have many representatives from the Industry and government. Mr. Olsen reported the activities of a recently held meeting in Florida, where many higher-level government representatives were in attendance. (See list of attendees in Olsen briefing) Mr. Olsen reported that there seemed to be general agreement on the concept of simulation based acquisition in the government sectors, but the issue for discussion is "where do we go from here?"

Simulation Based Acquisition is an extremely large issue, which can affect the entire Defense Industry. However, at this time Industry and Government have no idea how large the issue is.

Attempting to address the issue without bounding the size can do more harm than good. But more than just size alone, where do we start to address the issue. Attacking the situation at the wrong interface could prove to be time consuming and resource wasting. Everyone in attendance agreed that SBA is a big problem and we don't even know where to start or how big a problem it is, if it is a problem at all. After considerable discussion the executive committee agreed that the next step should be a government sponsored study using Industry and Government resources to define the problem and describe both the intended system function, and the barriers (political and technological) standing in the way. For instance, there are modeling and simulation programs in existence today that are tightly integrated with legacy systems and new models that can help with the design of a ship. However, the approach, models, and structure and expertise are totally different for the design of an aircraft. So the modeling and simulation for ship construction might not be that pertinent to a higher level of conceptualization in SBA. It was also discussed that today, the Industry is approximately 25% ready in terms of the ability to correctly model most of the dynamics of a system. This is because there is a disparate level of modeling information between disciplines such as Computational Fluid Dynamics and manufacturing simulations or cost models.

Most of the Industry participants stated that their companies have worked on the problem, so that SBA as an effort was actually a late start and maybe behind the curve. However, attempting to pull the Industry and government together in an orchestrated fashion might be a worthwhile effort. But resources are needed in order to prove the benefits of a total program of SBA, and to size how much the structure would cost. The cost may be out of the range of resources willing to be spent on the issue. Most agreed that any approach would have to be incremental. The solution would, more than likely, be based upon application and environment, (boats, tanks, plans) so even if an incremental approach were pursued it will be difficult to integrate all the approaches in a single concept or program.

### **Presentation of Cycle Time Reduction by Young Shin, OSD**

The data presented has not yet been reviewed by OSD management. It will be soon.

Information was presented regarding the historical cycle time for defense system cycles, defined from Milestone One (MS1) to first production item or ORP.

In the proposed actions of the government "Cycle Time Reduction Team" the predominant theory presented was that a 25 % reduction in current program cycle time was not going to get under the 66 month intended benchmark. Because of this a larger percent reduction was intended to be proposed. This reduction would result in an average cycle time less than 66 months. This reduction concept was based on the argument that

the defense acquisition process should be changed to use only mature technology. This means that many (about half) of the existing acquisition process would have to be switched to the S&T side, and the cycle time was then defined to be from EMD through manufacture. A potent remark made during the presentation was that the activities required for development could not be shortened or skipped, so the acquisition cycle time should start later in the whole technology development and transition process.

There was a lot of discussion about whether this was merely a matter of semantics, since the activities required for development have been shortened by Industry wholesale. One comment was that anyone could shorten a cycle time by 90% by defining the start to be just before the finish.

Another discussion was around the use of incremental development, such as the Evolutionary Defense Acquisition (EDA) proposes (The study and paper promulgated by the Simplified Contracting Team of the Industry Affordability Task Force). With PLANNED block changes to the system (upgrades) that do not correct deficiencies, but do add technology not ready to be transitioned at the initial development time, defense systems can be fielded much sooner than presently done in current acquisition.

The executive committee, in general agreement with cycle time reduction, but not with the limited 66 month final result, nor the redefinition of phases to achieve the perceived reduction, agreed to continue participating as team member of the government's cycle time reduction process action team. Mike Robinson, backed by NCAT staff when required would be the task force point of contact.

**Presentation by Mr. Stan Soloway, the new PUSD for Acquisition Reform (Ms. Donna Richbourg, Principal Deputy also in attendance)**

The presentation started with an explanation of Section 912 which spells out a smaller OSD workforce, with focus on suppliers not supplies, and a workforce focused on Total Ownership Costs (TOC) not simple acquisition cost.

Further discussion brought out the fact that Section 912(e) resulted as an independent review from the Defense Science Board and Section 912 (a) of the Bill spells out the exact number of cuts in particular OSD organizations. This activity is totally about re-defining the entire acquisition work force, which includes the requirements community and other jobs. This final restructure is scheduled to happen in the summer 1998.

A big issue in this activity is how to retrain the workforce, what part of the workforce to train, what is the real skilled workforce, and then design an affordable system to be used by the new acquisition workforce. OSD/AR has been working with the Lean Aircraft Initiative (LAI). The Planning Programming Budgeting System (PPBS) is an important point that will be brought up in potential policy changes with regard to the costs of program instabilities. Open systems is also a method to re-engineer the sustainment process, a MAJOR issue in future acquisition reform activities. For education

requirements and resources (courses available etc), OSD/ AR will survey and use the full environment (NCMA, DAU, Lunch speakers, Short Courses, etc).

The last point of information provided by Mr. Soloway was the DSAC is now under AR. The DSAC is NCAT's Affordability Task Force main entry point into OSD. May 4th is the kickoff of Acquisition Reform Week III.

Actions:

For Simulation Based Acquisition, Mr. Olsen should strive to brief the DSAC, which will introduce the project to Dr. Gansler. Prior to the briefing the SBA team should research potential costs of studying the problem, i.e. sizing the issues. Have a recommended budget ready, along with a proposed activity schedule. The key is to make this a project about defining the real SBA project. Get sponsorship to look at issues, barriers, and solutions.

For NCAT: Get additional Raytheon involvement in the Task Force, or clarify the present situation with Raytheon participants. Also, by July 2, provide the executive committee the Defense Technology Objectives for review, as a part of NCAT involvement on National Research Council and Joint Defense Manufacturing Technology Panel.

- Next meeting of the Executive Committee and the Team Chairmen will be July 30<sup>th</sup> 1998.
- The following meeting of the Executive Committee and the Team Chairmen will be concurrent with the S&T Affordability Conference, which will be held October 1-2 1998 in Washington D.C.



**Minutes of**  
**Industry Affordability Task Force**  
**National Center for Advanced Technologies Offices**  
**Washington, DC**

**July 30, 1998**

The Executive Committee met this date from 0930 a.m. to 3:00 p.m. The purpose of this quarterly scheduled meeting was to review the activities of ongoing team activities and to meet with officials of the Office of the Secretary of Defense. Task Force Team Chairmen attended the session, Pertowski, Sustainment Team; Kohls, Manufacturing Team. Government representatives included Dr. Delores Etter, DDR&E, Dr. Spiros Pallas, OSD, and Dr. Jay Mandelbaum, OSD. Mr. Sinnett, Boeing St. Louis, chaired the session which included a review of the Task Force's activities and the Defense Systems Affordability.

**NCAT welcome and chairman opening remarks:**

Mr. Syslo welcomed the group, and highlighted the agenda events. Mr. Sinnett welcomed the executive committee and the meeting commenced with Dr. Pallas' comments.

**Dr. Spiros Pallas, Total Ownership Costs (TOC):**

Dr. Pallas spoke on the present thinking within the department regarding Total Ownership Costs of weapon systems. TOC or Total Ownership Cost Reduction is an idea which expands the traditional concept of Life Cycle Costs (LCC) to include issues of indirect costs. The thrust of Total Ownership Costs is to reduce operations and support (O&S) costs, use the savings to modernize the forces while remaining in a zero growth funding environment.

A major thrust within the department remains "Better- Cheaper- Faster." With regard to the "Faster" part of the trio, the emphasis is on Cycle Time Reduction (CTR), with several internal Pentagon groups involved. Four years ago the Defense Manufacturing Council (DMC), the predecessor to the Defense Systems Affordability Council, concentrated on these issues relative to manufacturing. Manufacturing at this time was defined as being broader than only the "shop-floor" environment. Big "M" as it was referred to, included the entire manufacturing enterprise. The focus of the DMC was to reduce LCC through the use of several initiatives: "Open Systems Infrastructure" and Cost as An Independent Variable (CAIV) which is somewhat akin to commercial "Target Pricing," were two of these initiatives. These initiatives, however, generally aimed at the up-front development part of the acquisition process. The change to the TOC concept was made to allow a look at ownership and operating costs. The change in direction for the Defense System Affordability Council then was "Look at what drives the cost drivers



in all weapons systems, in both the vertical (intra-company) and the horizontal (looking across all parts of the defense system)."

The OSD staff is now looking at establishing several pilot programs under the auspices of Section 912 to proof the initiatives. One of the general ideas within these initiatives is to allow Program Managers to make program changes with total ownership costs reduction being the driving factor. Understanding the cost drivers, however, is a very difficult thing to do because of the limited visibility into actual costs. There will be more reliance will be on the PM to identify ways to make cost drivers more visible. Activity Based Costing (ABC) might be the potential system to allow a better view inside costs of weapon systems. ABC has support of the National Performance Review. Choosing the correct model to follow will be the challenge.

In the final analysis, the issue of priorities will decide the direction. Whether modernization, readiness, or training or some of all three is pursued the important factor within OSD today is achieve balance. The question of whether the department can actually incentivize companies so that savings would result in some reward to the company. In addition, cost share ratios, and price will have to be debated to ascertain which is the appropriate path to follow from a defense perspective. The arguments are compelling on both sides of the issue. Should it be enough that an item, system, or service be provided at costs less to the government, or should the government restrict revenues and profits to be in line with politically acceptable levels of profit? Should the department care how much the company makes, as long as product is high quality, service is excellent, and warranties are all encompassing?

Further discussion followed raising these points:

- Categorization of LCC saved could be done through the VAMOSC program.
- Modeling on TOC or LCC is not as standardized or as well understand for Legacy systems as for new systems. LCC is fairly well understood and modeled for new systems, e.g. crew size, SFC, or other LC factors. The DSAC will be working more TOC or LCC costs estimates into decisions on Legacy systems.
- Use of "variability" and "stochastic" methods instead of deterministic methods (e.g., parametrics) to measure. As an example, readiness levels can help.
- There is a need for incentives for Industry and Government to make this all happen. The problem being faced by PMs is that if some work or risk results in reduced O&S costs, then the accountant takes the resources identified as "savings" away. There is no incentive for PMs to pursue O&S savings when it might have a detrimental effect on the total program prosecution. If the idea is to use savings in O&S costs for force modernization, why would a program manager identify savings that run the risk of being siphoned off to another program. One idea could be that some of the savings should be kept in the program for the PM to use to apply smart things to reduce cost more.

## **Dr. Delores Etter, DDR&E:**

Dr. Etter made no formal presentation, but discussed, in informal conversation, a number of issues with the executive committee members. These subjects are presented below with no attribution as to origin. The issue could have been brought to the table by anyone present.

### Readiness Levels:

There has been some interest registered with regard to readiness levels and the potential for affordability issues interfering with the Readiness Levels required across the services.

### Research & Development resources applied to Science & Technology:

Discussions revolved around the need for a high degree of resource stability to support research and development in the S&T area. It is presently difficult to get resources applied to modernization. Annual TARA evaluations for 6.2 and 6.3 programs could be the assist needed to provide stability. The TARA process has been successful in the Materials program. That process could serve as the model for review of the entire S&T program under the cognizance of DDR&E. Affordability Metrics are being created to use for the TARA process. The Industry Affordability Task Force volunteered to review the metrics from an Industry perspective prior to finalization

### R&D Levels:

The Defense Science Board has been working to seek the appropriate level of R&D. Their effort includes an attempt to determine benefit or consequence allowed by R&D spending. Measuring the specific gains (performance or cost reduction) produced by specific resources applied could be a fallout of their work. Pharmaceutical companies are good models for levels of application of R&D resources. These companies spent 3% of total sales, and this for a 250B defense budget is \$8B. Right now Defense R&D spending is slightly over \$7B. A comparison of international resource levels for R&D might add increased visibility into this situation.

### Manufacturing Technology:

ManTech and IPPD are important initiatives because they deal with PROCESS research, whereas traditional research is mostly focused on Product Development and performance.

### Government Laboratory Personnel Recruiting:

Difficult to recruit top talent in aerospace and defense. Reasons for unattractiveness are (1) Salaries (both Government and Industry are lower than other sectors, i.e. information systems, biotech etc.) and (2) The lack of knowledge or understanding of what goes on in the defense establishment environment.

### Commercial Off-the-Shelf (COTS):

There is not much new work on COTS, because of the need for seamless integration. COTS still is reporting mixed results because of different environments, for example office equipment works well, but replacing a card in an avionics box may not work as well. It is certainly not as easy. Interface management of commercial equipment may turn out to be an important factor of COTS.

### **Current Activities of the Industry Affordability Task Force**

Mr. Syslo presented the activities of this committee and its standing teams.

### **DR. Jay Mandelbaum, OSD:**

Dr. Mandelbaum presented the current activities of the Defense Systems Affordability Council. His briefing included information on: the lead programs as agents of change (seven CAIV "flagship" programs), plus the other pilot programs as part of Acquisition Reform, the Current DSAC Focus Areas and the DSAC Strategy Paper. The objective of the strategy paper is to articulate top level goals, including objective metrics. For example, an objective might be, "reduce Cycle Time by 40%." Some of these objectives are a direct result of the NPR goals. NPR says increase procurement to \$54B by 2001 and \$60B by 2005. In order to achieve this, a reduction in O&S costs by about 10% might be required to provide the offset.

Discussion followed, revolving around the Warfighter. Could there be potential conflict of philosophy of concepts manifested in the choice to spend savings on increased op tempo or improved readiness levels now, not just procurement (modernization) for 10-20 years in the future? Awareness of these differences is needed.

Further explanation of the DSAC activities:

Alignment of the activities of the groups associated with or subordinate to the DSAC. There are 56 initiatives that the associate groups are working on or trying to apply. DSAC working now on cross association of these initiatives.

Next PEO SYSCOM Commanders Conference is in the planning stage now. Dates are OCT 19-20 1998. Survey of PEO and Syscom commanders indicate that the key subjects were downsizing, program stability, Total Ownership Costs and Acquisition Reform. TOC will have to be better defined. Acquisition Reform needs strategy explained. Program Stability

The DSAC executive committee is gathering in importance. Plenary sessions have been disestablished because of marginal utility since they were just information sessions that consisted of briefings.

The Industry Executive Committee voiced concern that Metrics will take 1-2 years. It was suggested that an off site to kick off the group and speed up the process might be more useful.

#### **Executive Committee New Business**

#### **IPPD Team Briefing. (Joe Syslo for Dr. Whatley)**

The IPPD Team under the leadership of Dr. Merle Whatley has had its first meeting to reconstitute the team and formulate the first concepts of direction the team will pursue. This activity is in response to inquiries made by the Navy for the current activities of Industry in IPPD

#### **Manufacturing Team Briefing. (John Kohls)**

The status of the team's activities was briefed by Mr. Kohls. Two workshops were held to delineate the process and the data of the top ten cost drivers of manufacturing from an Industry perspective. There was a suggestion by the executive committee to make the following additions to cost elements: test and cost of quality. An additional consideration is how to capture the cost of work in progress, or material waiting processing. Additionally, inventory should be explained or defined.

It was unanimously agreed that all of the cost elements be defined to avoid confusion. It was also suggested that work be done to split the different elements of Material (BOM) to a lower level in order to get real effects.

#### **Sustainment Team Briefing. (Ted Pertowski).**

The status of the team's activities briefed by Mr. Pertowski. Team activities to date have been primarily data and information gathering. The Team has met or interviewed several top DOD and service leaders on the issue of sustainment with emphasis on the support in O&S.

#### **Task Force Update (Joe Syslo).**

#### **S&T Affordability Conference**

The executive committee will meet concurrent with the Oct 1-2 Affordability Conference. NCAT has 60 seats for the Oct 1-2 conference. Everyone should supply four names to NCAT for invitations.

#### **Logistics Reform Focus Day**

NCAT has been asked to supply four speakers and four displays. Raytheon and Rockwell are committed to displays, and Boeing has committed one speaker.

### **Manufacturing Excellence Award**

Nominations for the annual Defense Manufacturing Excellence Award are being sought. This award will be made by the Association of Manufacturing Technology at the Defense Manufacturing Conference in New Orleans in December.

## **Appendix B**

### **S&T Affordability Conference Agenda** *October 2-3, 1996*

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# Agenda

## S&T Affordability Workshop

The Sphinx Club at Almas Temple  
1315 K Street, N.W.  
Washington, DC 20005

### October 2, 1996

- 0730-0800    **Registration & Continental Breakfast**
- 0800-0815    **Welcome & Expectations**                      Dr. Anita Jones
- 0815-0945    **Keynote Addresses on S&T Affordability**
- DoD                                      Hon. Noel Longuemare
  - Industry                                Mr. James Sinnett
  - Academia                               Professor Joel Moses
- 0945-1015    **Break** (View Displays/Exhibits)
- 1015-1130    **S&T Affordability Strategy**
- Government Overview                      Dr. Lance Davis
  - Industry Affordability Task Force Overview                      Mr. Joe Syslo & Professor Dan Schrage
- 1130-1245    **Lunch**
- 1245-1530    **S&T Affordability Projects ("Case Studies") - 30 min each**
- Next Generation Soldier (NGS)                      Mr. Patrick Snow & Ms. Susan Pasternack
  - Interferometric Fiber Optic Gyros (IFOG)                      Ms. Persis Elwood
  - ACTD Strategy & Example                      Mr. Tom Perdue
  - Power Electronic Building Blocks                      LCDR Cliff Whitcomb




- Military Products From Com'l Lines      Ms. Mary Kinsella

1530-1545    **Break**

1545-1730    **Panel Sessions – Scoping the Topic**

- IPPD/IPTs in S&T
- S&T Training & Education on Affordability
- S&T Transition to Acquisition
- Affordability in the DTAP/TARA Process

***Focus on  
“Best Practices”***



1730            **Adjourn**

1745-1845    **No Host Cocktail Hour** (View Displays/Exhibits)

### **October 3, 1996**

0730-0800    **Continental Breakfast**

0800-0900    **Transitioning Affordable Technologies to  
Products – Boeing 777**

Mr. Rich Crispo

0900-1000    **Panel Sessions Continue – Next Steps**

1000-1030    **Break** (View Displays/Exhibits)

1030-1145    **Panel Reports**

1145-1215    **Summary, Next Steps, Q&A**

Dr. Anita Jones

1215            **Adjourn**

## **Appendix C**

### **S&T Affordability Conference Critique Results**

*Oct 1996*

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## S&T AFFORDABILITY WORKSHOP FEEDBACK SURVEY RESULTS

- **Total Respondents: 87**
  
- **Workshop Attendee Affiliation (in descending order of group size)**

⇒ Industry	24
⇒ AF	19
⇒ Navy	18
⇒ Army	9
⇒ OSD	7
⇒ Other	4 (2-Academia, 2-OGA)
  
- **Workshop Attendee Responsibility (in descending order of group size)**

⇒ DTAP/TARA	22
⇒ Industry (Defense-related)	21
⇒ Afford. Pilot Program Mgr.	15
⇒ Other	15
⇒ Weapon System Pgm Office	9
⇒ DSTAG	8
  
- **Overall Impact of Workshop**
  - ⇒ Good overall ratings and individual panel ratings
  - ⇒ Majority (98%) thought workshop should continue and planned to attend future workshops
  - ⇒ Most (38%) encouraged workshop every 9 months; next choice every 6 months (32%)

## **S&T AFFORDABILITY WORKSHOP GENERAL COMMENTS**

- **Case Study Presentations Clear Winner In What Attendees Liked Best**

- ⇒ 33% felt case studies (including Boeing 777 talk) were best
- ⇒ Followed by workshop providing the opportunity for exchange of data and the panel sessions

- **Insufficient Time For Panel Sessions To Address Issues Was What Attendees Like Least**

- ⇒ Need more panel time and better focus/facilitization in panels
- ⇒ Case study spokesman should participate in panel
- ⇒ Articulate panel tasking more in advance

- **Make Workshop Better By:**

- ⇒ Providing more panel time
- ⇒ Improving case studies - enumerate successes/pitfalls, shorten, more breaks in between
- ⇒ Providing training and hands on experience
- ⇒ Better focus and clearer objectives

## **Appendix D**

### **S&T Affordability Conference Agenda** *June 10-11, 1997*

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## **Agenda**

### **S&T Affordability Workshop II**

**The Sphinx Club, Almas Temple  
1315 K Street, N.W.,  
Washington, DC 20005**

#### **Tuesday, June 10, 1997**

**0730 Registration & Breakfast**

**0800 Welcome** Dr. Lance Davis, ODDR&E

**0810 Keynote Address** Mr. Joseph Eash, DUSD(AT)

**0830 Service View: S&T Affordability Update** Dr. Helmet Hellwig, USAF  
Dr. Richard Chait, USA  
Dr. Jim DeCorpo, USN

**0940 Industry Perspective: New Attack Submarine** Mr. John Alden  
Electric Boat Corp.

**1015 Break**

**1030 Learning for Leaders (Mini Training) First Session**

- **Panels A/B: 6 Sigma** - Ron Randall (Rooms #2 & #3, Mezzanine level)
- **Panels C/D: QFD** - Thomas Buell (Oasis Room, Street Level)

**1200 Lunch**

**1300 Learning for Leaders (Mini Training) Second Session**

- **Panels C/D: 6 Sigma** - Ron Randall (Rooms #2 & #3, Mezzanine level)
- **Panels A/B: QFD** - Thomas Buell (Oasis Room, Street level)

**1430 Break**



- 1445-1730    **Panel Discussions (Breakout Sessions)**
- Panel A - Culture Change Panel
  - Panel B - Education & Training Panel
  - Panel C - Metrics/MOE Panel
  - Panel D - Transition Panel

1730-1830    **No Host Reception**

**Wednesday, June 11, 1997**

0730            **Breakfast**

0800            **Best Practice Case Study Presentations**

	<u><b>Program</b></u>	<u><b>Attributes</b></u>	<u><b>Presenter</b></u>
0800-0830	<b>MLRS ATD</b>	IPTs/Metrics/Training	Allan Gamble MICOM
0830-0900	<b>AEM/S</b>	Teaming/Transition	Jeff Benson, NSWC
0900-0930	<b>C-17 Best Practices</b>	IPTs/Teaming/Transition	Tracy Houpt AF Wright Labs
0930-1000	<b>HAE UAV</b>	CAIV/Transition	Doug Carlson DARPA

1000            **Break**

1010-1130    **Panels Reconvene**

1140            **Panel Reports, Q&A**

1230            **Adjourn**

## **Appendix E**

### **S&T Affordability Conference Agenda** *October 1-2, 1998*

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## **S&T Affordability Conference**

**Date: October 1-2, 1998**

**Location: Doubletree Hotel, Arlington, VA  
Plaza Ballroom**

**Purpose:** Improve affordability awareness among science and technology and acquisition personnel by exchanging views of ongoing initiatives in S&T affordability, acquisition reform, and logistics reform.

### **October 1<sup>st</sup> - Morning**

0800 **Registration & Continental  
Breakfast Reception Area**

0830 **Welcome** Dr. Lance A. Davis, Dep Director for  
Defense Research & Engineering  
(Laboratory Mgt/Technology Transition)

0835 **Government Keynote** Mr. Dave Oliver, Principal Deputy Under  
Secretary of Defense for Acquisition and  
Technology

0900 **Industry Keynotes**

- *Prime Contractor Perspective* Mr. Daniel P. Burnham, President & Chief  
Operating Officer, Raytheon Company

- *Small Contractor Perspective* Mr. Larry Rhoades, President, Extrude Hone

0950 **Break** Reception Area

1010 **S&T Affordability Update** Mr. John B. Todaro, Director, Technology  
Transition, Office of the Director of Defense  
Research and Engineering

1030 **Service Affordability  
Presentations** Dr. Mike Andrews, Director for  
Technology, Office of the Assistant  
Secretary of the Army for Research,  
Development and Acquisition

Rear Admiral Paul G. Gaffney,  
Chief of Naval Research

Dr. Helmut Hellwig,  
Deputy Assistant Secretary for Science,  
Technology & Engineering, Office of the  
Secretary of the Air Force (Acquisition)

1200 **Lunch**

Federal Hall

**October 1<sup>st</sup> - Afternoon**

1300 **S&T Affordability Best  
Practice Presentations**

Guided Multiple Launch Rocket System  
Mr. Allan Gamble, Army Program Manager  
  
Composites Affordability Initiative  
Ms. Jennifer Koury, Navy Program Manager  
  
Next Generation Transparency  
Mr. Robert McCarty, USAF Program  
Manager  
  
Miniature Air-Launched Decoy  
LtCol Walt Price, DARPA Program  
Manager

1500 **Break**

Reception Area

1530 **Panel: S&T Transition**

***Moderator:*** Dr. Lance Davis, Deputy  
Director for Defense Research and  
Engineering (Laboratory  
Management/Technology Transition)

***Panelists:***

Dr. Gary Denman, President & CEO,  
GRC International, Inc.

Col Jeffery Sorenson, Project Manager,  
Night Vision/Reconnaissance, Surveillance,  
and Target Acquisition

CAPT Charles (Tom) Bush, Program  
Manager, Surface Combatant Ship, DD-21

Colonel Robert (Bob) Lyons  
Joint Strike Fighter

Mr. Herm Reininga, Vice President for  
Operations, Rockwell Collins Avionics and  
Communications Division

1700 **Adjourn**

1730 **No Host Reception**

Federal Hall (Lobby level)

**October 2<sup>nd</sup> - Morning**

0830 **Continental Breakfast**

Reception Area

0900 **Panel: Commercial Technology  
Transition & Affordability**

**Moderator:** Mr. Joe Eash, Deputy Under  
Secretary of Defense for Advanced  
Technology

***Panelists:***

Mr. Paul Stone, Director, Federal  
Technology/Business Development, Dow  
Chemical Company

Mr. Robert Brown, President, Deneb  
Robotics

Mr. Mike Geller, Chief Technical Officer  
Lucent Technologies, Government Solutions

Mr. John Cole, Director, C4I Operations,  
Motorola Space and Systems Technology  
Group

Mr. Robert Deutsch, Director of Federal  
Systems Engineering, Cisco Systems

1030 **Break**

Reception Area

1045 **Acquisition Reform Update**

Ms. Donna Richbourg, Principal Assistant  
Deputy Under Secretary of Defense for  
Acquisition Reform

1115 **Logistics Reform Update**

Mr. Roger Kallock, Deputy Under Secretary  
of Defense for Logistics

1145 **The Way Ahead/Summary**

Dr. Lance Davis, ODDR&E

1200 **Adjourn**

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## **Appendix F**

### **Process Maturity White Paper**



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# **“An Approach to Process Maturity”**

**an NCAT White Paper**



**NCAT**

**The National Center for Advanced Technologies  
Washington, D.C. 20005**

## **Introduction**

In the pursuit of opportunities of collaborative activities with industry, the Defense Manufacturing Council's Executive Committee sought an examination of the elements of an approach to process maturity (See Appendix A). The results of these examinations are expressed in this white paper within the general context of "maintaining continued technical superiority through introduction of new manufacturing processes for each weapon generation." In addition to discussions of process maturity at the enterprise level and the shop floor, the paper targets the areas of what the DoD approach to process maturity should be in terms of:

- Requests for Proposals
- Contract Incentives
- Source Selections
- Process Maturity Criteria
- Funding Profiles to achieve the Advantages of Manufacturing Process Maturity

This paper then is the result of the collective thoughts of contributing members of the Executive Committee of the Industry Affordability Task Force. The outline followed is: an examination of process maturity from the viewpoint of the overall enterprise (managerial processes), and the maturity of process on the manufacturing floor, the government approach to process maturity in the Request for Proposal (RFP), Source Selection, and Contract Incentives. Maturity Criteria are defined, and some thoughts on funding profiles are provided, followed by a review and list of recommendations.

## Process Maturity

Processes are pervasive throughout an organization, and usually involve the entire organization, as well as the organization's external interfaces (the customer). Therefore, changes to any process within a company probably necessitates change to the entire organization, whether by design or by result of the impact of change. It probably includes change to the customer relationship. This is due to the potential interface changes that could result because of the process change itself. Currently, many companies have either undergone or are in the throes of some form and degree of reengineering their organization. The intent of the activity, for the most part, is "increased competitiveness." In some cases it is company survival. For defense companies it is civil/military integration.

Business Process Reengineering (BPR) is defined as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance,...quality, cost, service, and speed."<sup>‡</sup> The "process" in process reengineering can be a simple, one channel series of events, or a complex "systems" (groups of processes). Unfortunately, there seems to be little engineering behind the BPR nameplate. An ARPA sponsored workshop on Process Technology recently concluded that process engineering in general (for both manufacturing processes and management processes ) is less well developed than software engineering.<sup>§</sup> The lack of a mature Management Process Engineering discipline and a pool of Management Technology to draw from is an inhibiting factor that slows down the rate at which individual companies and the industry as a whole can improve their management capability maturity levels.

The Aerospace Industry is now involved in this reengineering phenomenon, and whether "downsized, right-sized, reduced, or streamlined" reengineered companies (and their processes) have demonstrated a variety of impacts, not the least of which has been the reduction of the sector's workforce by 495,000 over the past five years. In spite of the cuts, the record profits, and resulting efficiencies, questions remain. Has the reengineering gone far enough, or too far? Is the resulting process correct? What are the determinants of the correct process? Most importantly... ***When is the process mature?*** For the determination of the maturity of the process opens the door to a series of questions and unknowns that start with ...When should the next iteration of process improvement begin? Where does the process fit with respect to the customer? How does this all affect my business? How much does all of this cost? Will margins increase as a result of the changes made? Will the integration of proven mature commercial processes increase the competitiveness of the Defense Industry?

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<sup>‡</sup> Michael Hammer and James Champy, *Reengineering the Corporation* ( New York: Harper Business, 1993 ), p.32

<sup>§</sup> ARPA Workshop "Process Technology," Center for Innovative Technology, Herndon VA, May 31- June 2, 1995.

We deal with two processes in this white paper discussion: processes on the manufacturing floor, and processes of management. Manufacturing process affects the factory floor directly; managerial processes affect the entire company, includes the factory floor, but encompasses “above the factory floor” processes as well. Factory floor processes deal principally with the fabrication of the product, managerial processes deal with the total enterprise. While there are differences in target outcomes, there are similarities when dealing with identifying process maturity.

With regard to the discussion of “proving the maturity of the process,” it could be said that a manufacturing process indicates “maturity” effectively through the use of readily available tools of measure. For example, in factory floor processes, maturity can be determined through the application of metric methods such as Statistical Process Control, and how far a repetitive process varies from a predetermined set of criteria (standard deviations from the mean). While they are effective tools of process measurement, the need to define the current relative maturity (where the process is or how mature the organization is at the moment) is of prime importance. Once defined, the maturing begins and the measurement along a predetermined scale can be accomplished. This is true for both on-the-shop-floor and above-the-shop-floor processes. However, the precision of measurement is different in each case. Where a manufacturing process can be measured and controlled with gauges and sensors, the managerial process is dependent on greater subjectivity of measurement. There are financial and programmatic sensors and gauges indeed, but “judgment” is by far greater in the interpretation and application of corrective action for managerial processes.

Accelerating the maturity of specific manufacturing processes is difficult to accomplish solely or even principally through organizations that are dedicated to the manufacture of specific products. Product focused work groups must adapt at least dozens, (more typically, hundreds) of manufacturing processes to the particular requirements of their products. They are not dedicated to the advancement of one manufacturing process, like high speed machining or super-plastic forming, beyond the needs of their products. There are, in contrast, organizations that are primarily focused on specific manufacturing process technologies and their advancement. Universities, DoD Centers of Excellence, company science & technology centers, specialty job shops, and manufacturing equipment builders are included in this grouping. Each has a different part of the spectrum of process change, and each can affect widespread process maturity. For example, specialty job shops take on the full responsibility for making their special processes work, but have little interest in teaching others the secrets of implementation. Centers of Excellence have considerably more scientific depth and are more accessible to the defense base but are not likely to promote and provide innovation in process equipment with the degree of commitment that technology focused equipment suppliers would bring to the task. Ideally, process maturation in this area should be performed by teams of :

- Companies who want to use manufacturing technology to make their products and must adapt them to specific requirements.
- Manufacturing scientists who can optimize process physics, and

- Manufacturing equipment suppliers for the commercialization, deployment and support of the technology throughout the industry.

What then of the maturity of managerial processes? Similar expertise is required to focus across the spectrum of process reengineering. Process maturity for the managerial process can be determined as the result of teams of expertise from various disciplines of the managerial process examining (Benchmarking), setting criteria for improvement, and measuring the change. The teams can be from within one enterprise or from several enterprises to address a common issue. As in the on-the-shop-floor process, managerial process reengineering is best served by diverse teams brought together in an organizational structure and continuous forum to address the needs of the industry. The difference is in dealing with the managerial process; judgment plays a larger role than the quantitative metrics of the shop floor process. In the case of on-the-floor processes, the structure for review and determination of criteria for maturity could be the JDL MS&T Reliance Panel, or some ARPA expertise. In the case of the above-the-floor processes, the structure and forum for examination and criteria building could be the Defense Manufacturing Council and the Industry Affordability Task Force, or the Next Generation Manufacturing experiment. Teams involved with the internal processes of an enterprise are best categorized as operating in the philosophy of Integrated Product/Process Development (IPPD). The starting point for each of these activities should be an assessment of what the current practices are. This is commonly referred to as "benchmarking."

## **Benchmarking**

Benchmarking, a commonly understood technique of assessing an organization's standing relative to a similar organization, then, should be the first step in determining the maturity of the process. By making the comparison, the direction of the improvement can be stated, the improvement effort can be sized, the levels of progress determined and, the degree of maturity at milestone events can be set. For example, Benchmarking a company by review of the successful processes in use at other similar organizations (companies) will:

- allow an understanding of the "best practices" available,
- discard tried but ineffective ideas,
- scope the ultimate goal of the process at maturity.

Successful Benchmarking is accomplished by the same people who will be empowered to change the process and be responsible for its daily execution as opposed to Benchmarking by a dedicated "Benchmarking team" not normally associated with the process. The ownership, understanding of the process, together with the personal interface and synergy between "marker" and "markee" organizations outweighs the utility of dedicated teams. Completing benchmarking however, tells you where you are,

but not necessarily where you need to be. In determining the “where the organization needs to be” process criteria becomes important. For example, one of the benchmarks for the defense industry could be, “the degree of civil/military integration achieved in the plant.

## **Process Maturity Criteria**

Determining process maturity is done in the aggregate. While quantitative measure at the system level may not be possible, process maturity can be determined by the summation of quantitative levels at the sub system (process or project ) level. For example, assume a certain machining process has been used in the production line for some time. A new machining technique has been identified and can be substituted for the original machining process that would increase the flow time of the manufactured part significantly, but yield would go down because tolerances can't be held as accurately with the new technique. The process cannot be considered mature until the yield reaches at least the rate prior to the machining change given the flow time increases. In the aggregate, the machining process change of a manufacturing facility caused the total rate/volume system to change. Maturity of this process can be measured against the criteria that sets the level of yield and flow time in a quantitative measurement. If the original process yield were 75 % and the new process yield were 70, the criteria for new process maturity could be set at anything above seventy five, or at any other discrete factor that would include whatever other parameters deemed important to define maturity. The entire manufacturing process however may be sensitive to the material involved and therefore would also necessitate improvements in the material area prior to acceptance of total system process maturity. The bottom line to this discussion is then the establishment of the criteria for process entry, exit and “go ahead” is a significant factor in determining process maturity. The same is true for managerial processes. If, for example, the cost system of an enterprise is incapable of tracking materiel throughput, the aggregate manufacturing process may not be mature enough to warrant a production go-ahead decision. In the aggregate the enterprise may not achieve appropriate margin levels to be profitable. The serious fault demonstrated in this particular analogy is that the enterprise doesn't know what the internal margins are because the cost system is not mature enough to capture them. One of the maturity criteria in this case could be, “maturity is determined when the level of precision of the cost system reaches throughput recognition on a daily basis.” (It could very well be “hourly” basis.)

Does a process then ever reach maturity? If continuous improvement is the philosophy in which we operate, a process becomes mature at the subsystem level, in the interim, that is, while other process improvements are sought, perfected and accepted to predetermined criteria. The process at the system level is only mature at the aggregate. What then are the criteria? The criteria need to be discrete expectations set in the pilot or proofing phase of initiating new processes, or expectations set relative to improvements to a benchmarked process. The following criteria are notional criteria that have actually been used in a major aerospace manufacturing facility to determine process maturity.

They are not yet part of a formalized process but are being incorporated in a company practice at the time of this writing.

**A process might be considered mature when it meets these criteria:**

- it has achieved its target cost,
- operators are trained and in place to perform the process in accordance with performance criteria,
- the level of performance approaches Cpk of 2.0, or a minimum of 1.33 (Four Sigma ) is realized,
- customer quality expectations are met,
- producibility is compatible with process capability,
- data collection features are in place and monitoring performance,
- commercial sources for equipment & materials exist,
- process is not dependent on unique subcomponents (e.g. P.C.B.'s & spares)

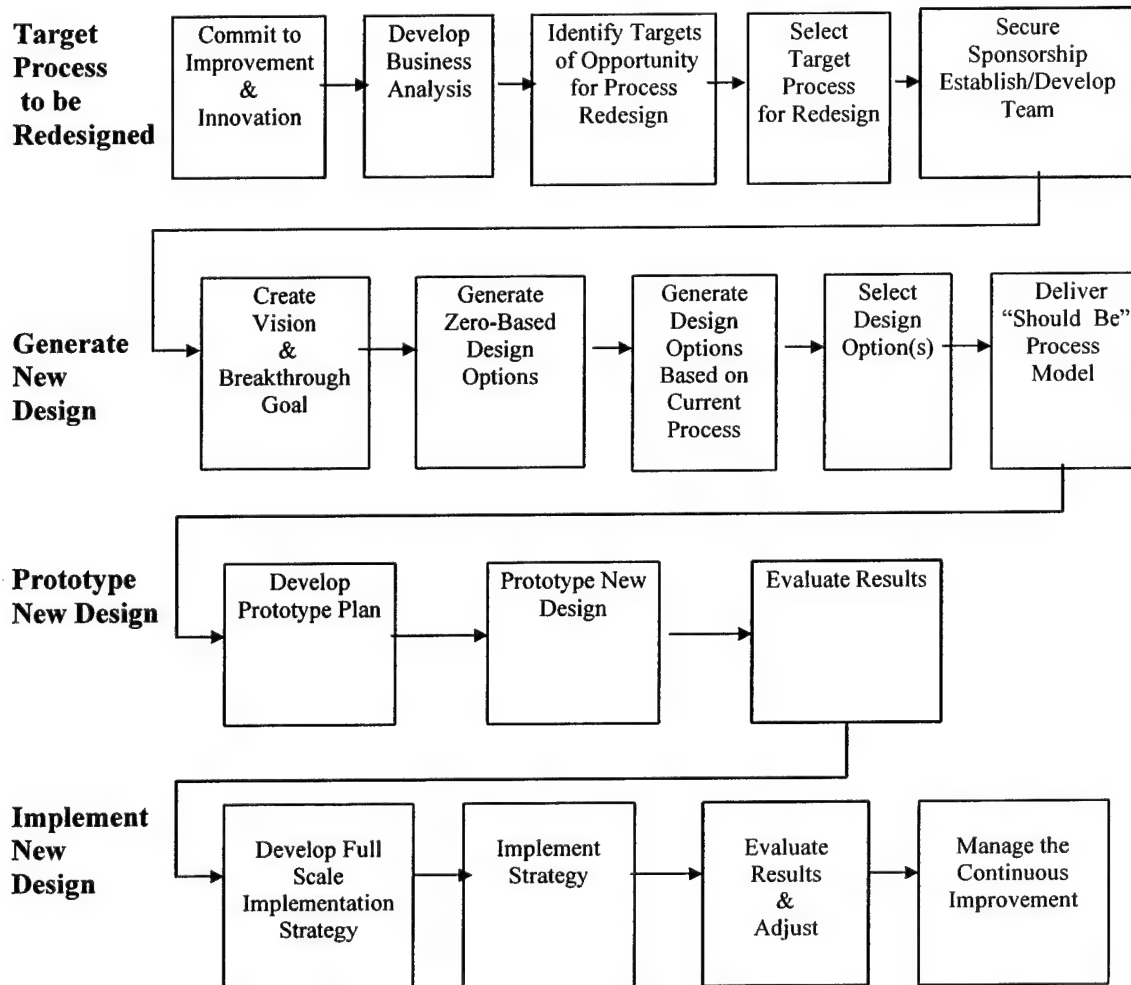
These criteria, however, may not be applicable to a process redesign at another plant even though product lines may appear to be similar. Tailoring criteria to the operation and the company is the preferred method. Determining whether a process is mature enough to start can also rely on measurement criteria for launching a process change. For example, the actual criteria for starting a work redesign model used at Collins Avionics & Communications Division are:

- Encourages radical change
- Provides early opportunities to obliterate/breakthrough
- It works
- Balances creativity and analysis
- Encourages good change management practices
- Easily communicated, understood, and embraced (people can relate)
- Facilitated internally
- Encourages generation of ideas in many different areas (systems perspective)
- Yields results as early as possible
- Facilitates desired outcomes with minimum shock to the business



These criteria illustrate a simple, direct to-the-point method of measuring the start of a process road to maturity. In the case of Collins, a process is considered mature when it becomes part of the culture, a more subjective measurement. The process that is followed after the criteria are met is depicted by the template “*Work Redesign Process Overview*” on page eight (Template A). There are two points within this template to measure the process. The first “Evaluate Results” in the “Prototype New Design” row, and the second “Evaluate Results and Adjust Accordingly” in the fourth row “Implement New Design. The first might be considered a measure of maturity to implement the process, the second a measurement of maturity of the process in consideration of upgrade or continuous improvement. While certainly not the only steps in examining and launching off on process redesign and measurement of maturity, this template is representative of a process actually in use.

### WORK REDESIGN PROCESS OVERVIEW



**Template A. Work Redesign Process Overview**

To illustrate how these process ideas should be addressed by the DoD, the following areas are discussed in more depth:

## **Request for Proposal, Source Selection, and Contract Award**

These process areas are specifically targeted in the DoD approach to process maturity. They require developing additional sub sets that deal with contract incentives, process maturity criteria, and funding profiles for manufacturing process maturity.

### **Request for Proposals**

The Air Force process action team of 1987-89 could be considered the forerunner of the work done within the past few years regarding the maturing of the Request for Proposal (RFP) process. The findings of that effort sought as a goal a process that would go from the issuance of an RFP to contract award in 120 days, maximize the use of draft RFP, limit documentation requirements, physically limit the size of the RFP, use oral and electronic responses, minimize evaluation factors, evaluation teams and audits, and rely on precise competitive range and past performance as discriminators. The recommendations of that effort were not universally embraced; RFPs remain voluminous, cumbersome and intricate. Response to requests for proposal continue to be expensive, time consuming efforts which have no guarantee of contract award.

Under the old paradigm, a "how to" requirement would be established, in addition to the criteria for process maturity. They would both be made part of the RFP. The offeror would then respond based on these requirements, with assurances of reaching the criteria. In an environment characterized by commercial practices and "what" rather than "how to" specs and requirements, it would seem more appropriate to establish broad process parameters based on the systems and measurements currently in practice in the Industry—but with price and affordability as the ultimate criteria.

An RFP in the changed paradigm, for example, could ask the offeror to identify processes critical to the achievement of specific affordability goals as well as the other program objectives. The processes would have to be explained in two categories: processes currently in use that will be employed to achieve the design intent, and processes which must be developed/matured to meet the design intent. "Design intent" must include affordability as a primary criterion. The offeror should be asked to demonstrate how and when these processes will be matured relative to a set of predetermined criteria or set metrics (e.g. high sigma, Cp/Cpk, target cost impact, risk mitigation, etc.). Summarizing, the criteria and measurement methods should be developed, and described by the offeror, not imposed by the solicitor. Timing for the maturation process is articulated in terms of the program milestones and coupled with a funding profile. (See discussion of funding profiles) Current work done by the Affordability Task Force has resulted in an approach to simplified contracting for streamlined ATD acquisitions that could be extrapolated for use in the overall proposal process. Four process drivers were identified along with six

key success criteria to demonstrate the elements of success in six different programs (see Figure 1 below). This simple approach to generating the request for proposal is merely an extension of common sense commercial practices in use. *What are my requirements? What is my level of resources available? What can I trade off for the resources I have budgeted to fund the purchase of the system that will fulfill the requirement?*

Process Driver Key Criteria	Requirements Management	Business Practices	Technology Infusion	Cycle Time	Program
Define Limited Goals	X				X-31, F-117
No Deviation from Goals	X	X	X	X	ALL
Minimum Formal Report		X		X	X-31, PLGR, B-777
Integrated Team Govt./Company	X	X	X	X	X-31, F-117, B-777, SUB
Real Time Data Insight	X	X	X	X	X-31, F-117
Simple Drawings, Specs & Tools		X		X	PLGR, Test Eqpt SUB

**Figure 1. Elements of Success for Streamlined ATD ACTD Acquisitions**

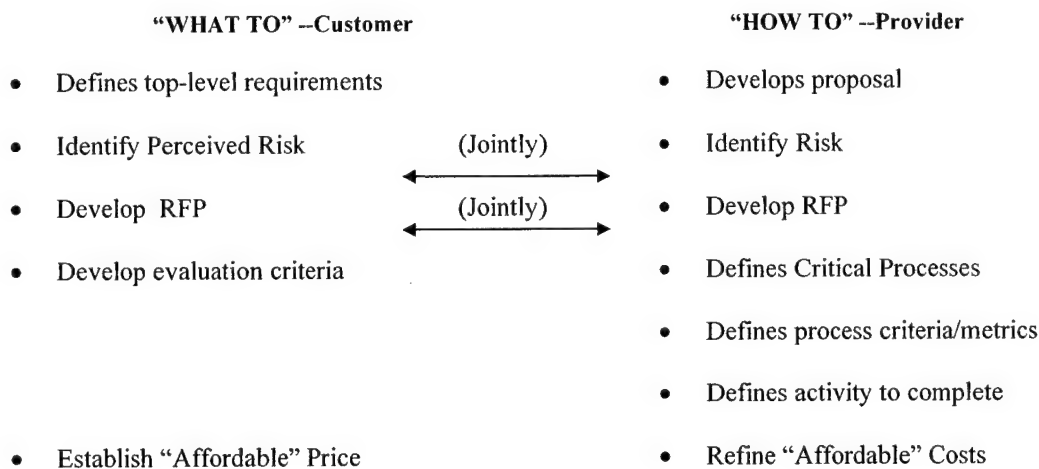
Traditional assessment methods are no longer relevant. For example, learning curve analysis of a proposed production run to set the price of a system loses applicability and importance to a "lot size of one." Future system acquisitions will be in small quantities. Learning curves should be discarded as planning factors in solicitations especially when pertinent to the price of system acquisition. This is a sound "first step" in de-coupling the cost-performance link. Hard and fast "requirements" in the RFP need to be balanced with Affordability in mind. Does a design to six sigma become a driver if the process to achieve that level causes the cost to be unacceptable? Might a significantly lower cost but sufficiently reduced variable process provide acceptable results? In considering criteria for proposals, doesn't the process that plans to remain environmentally benign throughout the life cycle become a significant discriminator in the system acquisition? The bottom line in maturing the process of Request for Proposals and the processes they contain is dependent on flexibility of requirements, traded to cost, that will allow affordable technical superiority, not "rigid" boilerplate RFP's.

## Source Selection

In the traditional manner, the pursuit of a government contract does not end with the submission of a proposal. Source selection encompasses the time from the solicitation to the selection and includes the evaluation and the negotiation. That activity could span a

total time of up to two years, with the norm approximately 11 months. Minimum times ran on the order of five months for the pre-solicitation activity, four months for source selection, one week for contract definitization and another week for contract review and award for a total of seven and a half months. During this span it is expected that the offerors will maintain the proposal team to answer any questions or generally respond to requests from the source selection authority. An intricate system of evaluation, criteria, screening, cost analyses (ICE, ICA), Standards, Factors, Areas, Items, Reviews (Manufacturing Management Production Capability, Contractor Operations, etc), and Pre-Award Surveys were performed. All of this adds cost to the system acquisition. To reduce that cost, a simpler, faster, more commercially oriented process is needed.

An ideal situation explained in the simplest terms would be a system of solicitation and offering where the two partners would operate in closer harmony to address the "What to"- the Customer Role in the process and the "How to"- the Provider Role.



In this scenario the customer would articulate the top-level requirements. The refinements, derivatives, analyses and tradeoffs for Affordability would then be provided by the offeror. The customer would then bound the parameters of the tradeoffs, so as to not degrade mission requirements but consider performance cost schedule and risk. This then would become the basis for the solicitation, fulfilling the jointly derived criteria would become the main component of the source selection. Assessing the processes (and their degree of maturity) presented by the offeror, the degree of risk stated and the risk mitigation plan, the performance achieved, and the price involved would be the evaluation factors on which to base the award. The Risk Mitigation Plan proposed by the offeror (and the Risk Assessment jointly derived) should encompass the entire program life cycle. A total understanding of the risk factors and how to deal with them is the principal ingredient to a successful program and realization of a producible product that fulfills all expectations. Understanding the program risk then supports schedule, cost, and the attendant resources required.

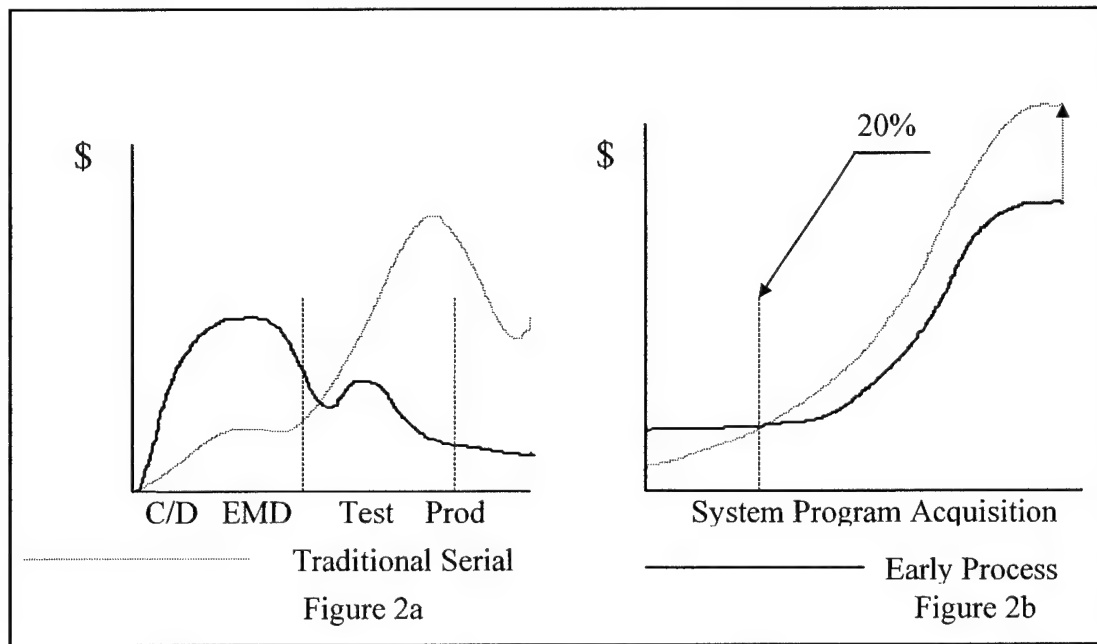
## **Contract Incentives**

To win or award a contract based on Affordability, stimulated in part by process maturity, would send a very strong signal and serve as a powerful incentive to encourage behavior geared toward process development and process maturity. However, a more powerful incentive would be the ability to expand market share by selling more product if the product were less expensive than before. The notion of using budget savings generated from Affordability enhancements to buy more of the product or to upgrade and enhance the product in the future, or pursue a derivative product would encourage industry to improve processes for affordability. After award, other incentives—geared to maintaining momentum—could be applied. These include an award fee based on the achievement of process maturity metrics for critical processes, or sharing the increased margins generated by the mature process implementation. Any contractual incentive mechanism must however be clean and simple. Creating intricate Return on Investment, or Discounted Cash Flow calculation tend to feed the bureaucracy. Esoteric measurements of “savings” or “cost avoidance” have been proven to be extremely difficult to measure. They only serve to increase the manpower necessary to oversee and audit plus the company resources needed to shadow and defend. Any incentive mechanism must be simple and quick!

## **Funding Profiles**

Notwithstanding any other changes made to the method by which we engage in acquiring weapon systems, consistency in funding is a paramount issue. Consistency of funding is essential to maintaining the momentum necessary to achieving large scale process maturity. There is a big investment required in changing the operation of a company, whether it is a machining process, or implementation of a new activity based cost system. Companies that take on large, complex programs to drive down internal costs, increase throughput, or quicken cycle time expend a large amount of resources. Normally these changes are undertaken with a certain income stream in mind. When that changes, the balance is disrupted, risk is perceived to increase and pressures to discontinue modernization heighten. The present IPPD philosophy has demonstrated that the imposition of desirable new methods that will reduce overall life cycle costs must be done early in program formulation. These innovations must be covered prior to attempting implementation. However, because programs will be perceived to be more expensive at their start, attempting to progress could in fact increase the pressures of program funding instability. Since this is exactly where the additional resources need to be applied, awareness of the benefits of front loading programs must increase, criteria for process maturity must be defined and understood, and measurement of program progress tracked.

These conditions are illustrated in the graphs shown in Figure 2. With respect to Figure 2a, program resource profiles will shift significantly to the left (earlier in program life) to reflect the incorporation of process improvement-oriented resources earlier in the project. It will be evident that overall program funding profiles will be diminished, as processes



**Figure 2. Program Resource Profiles**

(both manufacturing and managerial) are matured earlier, inserted in the program earlier, and production costs are reduced, as well as other life cycle costs. But the initial increases required to drive that maturity could be perceived as total program increases and suffer reduced support.

The impact on the early maturity of processes used in preparing to produce a product follows the curve depicted in Figure 2a. The early resource commitment to maturing the processes to be used in the system acquisition have proven to be the factor in the overall reduction of program costs. Couple these planning curves with the criteria and measurement of a performance measurement system of management ( which can forecast the success or failure of the total program within the first twenty percent of resource expenditures - Figure 2b), an effective process maturity-measurement mechanism can be created for the aggregate program, and used to track cost and performance. This early on tracking and measurement can be the confidence builder that will allow program funding stability.

## Summary & Recommendations

There are no prescribed solutions to process maturity. The culture of the organization is probably the best measure of a company's progress in bringing about process change. However, while it may be that a company considers its process mature when the change pervades the entire organization, that may very well be the next process that requires examination for potential change. On balance, a company whose culture recognizes change and incorporates it faster is probably the most successful.

There are big differences between Management Process Engineering and Manufacturing Process Engineering. Management Process Engineering is perceived to be a substantially less robust discipline than Manufacturing Process Engineering. A major factor in this reality is that Management Technologies draw heavily on information sciences but must couple them tightly to human behavior. Much of that phenomenology of this coupling remains a mystery with the result that Management Science has not produced a supporting Management Technology and remains a soft discipline without a quantitative constructive synthesis methodology. Efforts to improve specific management or contracting processes have significant promise, and those described in this white paper are of special near term interest to both DoD and Industry. The paper pointed out that there is a clear need for a comprehensive activity to create the theory, tools, frameworks, libraries, metrics, similarity measures, visualization techniques, simulations, training material, and industry deployment mechanisms that are necessary to develop Process Engineering and Management Technology that can meet DoD's needs.

The following points both summarize the discussion of process maturity in this paper and serve as ideas for recommendations for incorporating management process technology in policy and philosophy.

- Process maturity is determined in the aggregate. A process can be considered mature when the process change becomes part of the company's culture.
- Discrete processes within a system should be measured according to predetermined criteria prior to implementation. Discrete on-the-shop-floor processes are measured technically and objectively but follow the same rules of targeting - criteria setting - assessment - implementation - measuring - maturing.
- Interdependencies between processes are more complex in managerial processes, and judgment plays a larger role in assessment. However, the process to determine maturity remains similar to the technical assessment of the shop floor process.
- Solicitation requirements should be a cooperative effort between industry and government. Required process criteria and levels of maturity should not be evaluation criteria in RFP's, and proposals.
- Discarding the use of learning curves in RFP's is seen as the first step in decoupling the cost - performance link.
- Stable program funding and the up-front application of mature processes through Integrated Product/Process Development will help to achieve overall program cost reduction.

- Simple incentive mechanisms to allow companies to reap the benefits of lowering costs are the keys to good cost reduction incentives. Target pricing concepts need to be pursued more aggressively by defense acquisition leadership.
- Considerations of Affordability should be the "bottom line" in acquisition decision making.

*The National Center for Advanced Technologies would like to recognize the contributions of, and thank the members of the Executive Committee of the Industry Affordability Task Force, Team Chairmen, and team members who participated in gathering the data and providing ideas for this work. Questions pertaining to the paper and requests for additional data or background material may be directed to the National Center for Advanced Technologies, 1250 Eye Street N.W., Washington D.C. 20005, internet: ncat@ncat.com*

*Joe Syslo, Director, Defense Programs*



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## **Appendix G**

### **Process Effectiveness Assessment**

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## PROCESS EFFECTIVENESS ASSESSMENT POLICY INTERPRETATION

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1250 Eye Street, N.W., Suite 1100,  
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April 19, 1996

The Process Effectiveness Assessment Policy statement and The Policy Interpretation describe a fundamental change in systems acquisition practice. The Policy is intended to foster disciplined integrated design and manufacturing processes during the design, development, and production of weapon systems. It also promotes the use of the advanced quality systems being applied successfully in today's highly competitive global economy.

The intent of the Process Effectiveness Assessment Policy is to provide a capability and quality profile of companies competing for, or implementing, DoD contracts. This profile, along with other assessments such as those relating to past performance and facilities can be used as an acquisition management tool for risk assessment/management and for motivating a capable, responsive industrial capability, both commercial and organic. It is not the intent of the Policy that procurement agencies specify or require specific processes or process metrics ("Degree of Maturity"). It is the intent that essential processes be identified by the company involved, and that specially trained DoD teams perform the relevant maturity assessments. Such assessments are not required for every procurement or RFP but should be conducted on a reasonable, periodic basis (determined by major program specifics and process change dynamics) at the facilities of contractors involved or about to be involved in a DoD procurement. This activity must be integrated with the single plant/common process facility initiatives.

As indicated in the Policy, the effectiveness, or maturity, of an enterprise's processes—(e.g., management, engineering, manufacturing, quality, procurement/subcontracting, and logistics support)—is a significant measure of the productive health and quality of that enterprise. Further, the evidence of continual improvement of those processes is a strong indicator of future health and quality.

Companies that are leaders in their field use the process assessment mechanism to measure competitive strengths and weaknesses and to drive efforts that will enhance their success in the marketplace. Smart buyers of major systems, products, or services use assessments of suppliers' processes to help calibrate and mitigate (or manage) the risk associated with any procurement. In this light, it is the purpose of this Policy to assist in making DoD a "smart buyer." When critical processes are truly effective and under control, the value benefits to the buyer (in terms of performance, delivery, schedule, cost, and quality/reliability) are greatly enhanced.

Included in these critical processes are those associated with interfunctional relationships (engineering/manufacturing/support), intercompany relationships (teaming, supplier

management), and customer relationships. These are often embedded in IPPD and IPT activities, and should be included in any process assessment initiative.

In support of the Defense Manufacturing Council, a root cause analysis of “problem” procurements was accomplished by a multi-discipline team from Industry and Government. The results indicated that a major cause of DoD acquisition problems is the imbalance between product/system goals and the maturity of engineering/manufacturing processes used to reach those goals. (e.g. stable and capable processes are needed to support design, production, operational use, and logistic support for DoD products and systems).

The old paradigm of the defense Industry/acquisition environment seemed to favor rapid, low-cost prototyping and development without a balanced emphasis on production. The Process Effectiveness Assessment Policy mandates earlier planning and development of relevant manufacturing processes during the development phase. As a consequence of doing the right technical tasks at the right time in the program life cycle, the traditional program funding profiles must likewise shift, pulling some of the normal production-oriented funding into earlier phases of the acquisition life cycle, [(Engineering and Manufacturing Development (EMD) or even Demonstration and Validation (DV)]. The Process Effectiveness Assessment Policy is intended to enable a new overall acquisition architecture and procurement approach by more completely addressing the production article along with its design and manufacturing process requirements. In addition, the Process Effectiveness Assessment Policy also requires the acquiring agency to establish source selection criteria which will aid in selecting contractors truly capable of implementing the intent of the technical and programmatic effort through effective processes.

The Policy clearly states that Industry—or individual companies—“owns” the processes that it implements to conduct its business and to address the issues outlined above. As such, each company will necessarily fully characterize each critical process and will define the metrics that measure process effectiveness. Only in this way can a company ensure that a process performs to requirements, is kept under control, and is amenable to continuous improvement.

The DoD assessment of a company's processes will utilize that company's current process performance metrics (along with historical process data) as one of the measures of process effectiveness. Additionally, those metrics that demonstrate process “institutionalization” should also be considered in the assessment. These include:

- **Process existence & evidence of scalability to production rates**
- **Process characterization/documentation**
- **Training required for implementation/operation**
- **Formal management disciplines that preclude process “short circuiting” critical steps**
- **Process Performance trend analyses**

- **Formal continuous improvement activity**
- **Best practice evaluations/benchmarking**
- **Leadership/commitment**

To fill out the "metrics" suite, a description of general process performance metrics is included in the JACG Report on Key Supplier Processes for Acquisition Programs. This report covers the dimensions of major processes in a very clear and definitive manner.

To assist in the evaluation of the metrics considered in an assessment, process maturity models such as those developed by the Software Engineering Institute (SEI) (e.g., Software Development, System Engineering, IPPD, etc), along with Quality Models such as ISO-9000 or ANSI/ASQC Q90, and manufacturing "models" such as the Air Force Manufacturing Development Guide and Maturity Matrix, can be helpful. It is important that these models not be used to specify requirements or "how to's," but be used as evaluation aids. Process Assessment activities must avoid any temptation to use "guidelines" or "maturity models" as specifications or contract requirements.

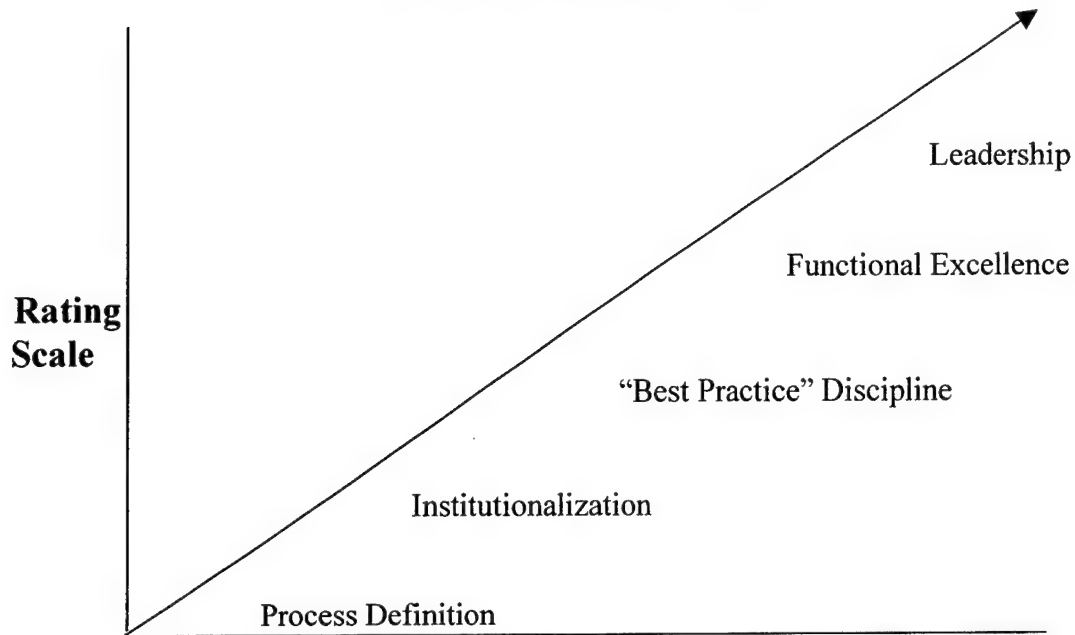
As clearly stated in the Policy (and defined in more detail in the JACG Report), Process Assessments should include those related to supplier/subcontractor management, and the related critical process effectiveness in second and third tier suppliers.

To maintain Process Assessment consistency and quality across all acquisition activities, OSD will assemble and train joint service assessment teams. These teams can help enable the implementation of "common processes" within a contractor's facility, as well as assessing the effectiveness of the individual processes.

The viewgraph copy showing a process maturation guide is meant to portray a "path to leadership" or a way to view process maturation. (Attached, see next page)

A list of those processes that should be considered in an assessment is attached to this supplement. It is intended that the list be updated as required to ensure relevance to all major procurements. (Attached, see next page)

### ***"Process Maturation Guide"***



### **Road Map for Progression to Critical Process Leadership**

#### **TYPICAL PROCESSES TO BE CONSIDERED FOR ASSESSMENT**

The Process Effectiveness working group endorses the general top level processes as defined by the NGS-IPT/JACG report. These are:

- Program Management
- Engineering
- Advanced Quality
- Manufacturing
- Purchasing
- Logistics/Sustainment
- Cost Control

However, in order to show a more detailed view, the following typical processes are those a major company might use. These are provided for information purposes.

#### **Systems Engineering**

- Requirements Analysis/Mission Analysis

- System Architecture/Structure Definition/Tradeoff's (cost, performance, etc.)
- System Requirement/Structure Flowdown
  - Interface definition, performance requirement/margins,  $c_{pk}$  flowdown, etc.
- System Performance Test Plan/Acceptance Test Plan

### **Product/Sub-system Design**

- Product/Sub-System Performance Specification
- Trade-Off Analyses - Alternative Product/Sub-System Approaches
  - Cost, time, performance, quality, technology maturity, manufacturability, and maintainability
- Design Specification Documentation/Revision Control
- Detailed Design
  - Electrical analyses/simulation
  - Logic/timing simulation, design margin/ $c_{pk}$  analysis
  - Reliability/FMEA analysis
  - Environmental stress (thermal, mechanical, electrical) analysis
  - Structural/platform analyses/simulation
  - Platform simulation (CFD, CEM, mechanical structure, control system, etc.)
  - Dynamics analyses - shock/vibration/combined loads/ acoustic/thermal
  - Design for producibility
  - Yield ( $c_{pk}$ ) analysis, Producibility design rules
  - Tolerance analyses (Product and Process Control)
  - Design for quality/reliability
  - FMEA analyses, environmental stress analyses
  - Wear/fatigue analyses
  - Yield and manufacturing variability analyses
  - Design for maintainability/support
  - Design for disassembly, diagnostics architecture
  - Test strategy
  - Field support/upgrade

### **Manufacturing Process Definition/Characterization**

- Matched Product Requirements and Manufacturing Process Characteristics
- Defined Process Control Mechanisms



- Variation Reduction Program (CPK, SPC, DOE)
- Best Practices Selection/Documentation/Benchmarking Processes

### **Quality**

- Institutionalized Quality Policy
  - Hardware, software, and systems
- Advanced Quality Concepts
  - SPC, variation reduction, trend analyses
- Quality Systems Management (Engineering, Finance, Manufacturing, Human Resources, etc.)
- Customer Satisfaction Assessment
- Supplier Quality Control
- Design Margin Control

### **Supply Base Management**

- Best Value Criteria Approach (vs. Low Price)
- Critical Requirements Definition and Flowdown
- Supply Base Processes and Product Requirement Match
- Supplier Process Metrics and CIP Program

### **Cost Management Processes**

- Non Value Added Process Elimination
- Cost/Value/Affordability Relationships and Analyses
- Design to Cost Processes - Cost as an Independent Variable
- Design for Reuse
- Supplier Value Chain and Cost Management
- Yield Projections and Improvement Program
- Life Cycle/Total Cost Status and Trends
- Cost Trade Off Analyses

### **Program/Functional (Engineering, Manufacturing, etc) Management Processes**

- Integrated Program Management and Functional Management Processes
- IPPD Process Maturity
- Self-directed Work Teams, IPT
- “Functional Excellence” Management Approach in a Team Environment

- Skills Relevance and Skills Maintenance
- General Management Involvement/Leadership

#### **Information Management/Architecture Processes**

- Rapid Prototyping, Virtual Prototyping and Simulation
- Risk Management Techniques
- Configuration Management/Revision Control
- Information Based Decision Mechanisms - Enterprise Wide
- Cost/Contract Performance Status, Trend Analyses

#### **Sustainment/Logistics**

- Environmental Protection/Control
- Safety/Handling
- Field Maintenance/Integrated Support (Test/Support Facilities)
- Field Upgrade Strategy
- Transportability/Servicing/Packaging
- Supply Support (Sunset Technology)
- Cycle Time (Support)

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## **Appendix H**

### **Evolutionary Defense Acquisition White Paper**

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# EVOLUTIONARY DEFENSE ACQUISITION

## Acquisition Teamwork and Cycle Time Improvements

The recent Cost as An Independent Variable (CAIV) and Overarching Integrated Product/Process Teams (OIPT) policies emphasizing cost and performance balance, ongoing tradeoffs and timely elevation of major tradeoff decisions to executive attention are excellent new programmatic themes in the Department of Defense. Current revisions to the DoD Directive 5000.1 and DoD Instruction 5000.2 reflect many improved acquisition concepts that the department has put forth as individual policy initiatives over the past several years, and which represent constructive improvements over the current series. Industry supports the inclusion of concepts such as the use of Integrated Product Process Development (IPPD), employment of commercial products, specifications, standards and practices, and acquisition management incorporating Cost as An Independent Variable (CAIV). Considering that the DoD-5000 documents are updated only about each half-decade, it may, however, be an opportune time to pause and ask why other such good ideas like Design-to-Cost, P<sup>3</sup>I, Acquisition Streamlining, Award-Fee, Value Engineering and Performance Specs were all started with high expectations, but somehow did not improve defense system affordability in a major way.

We believe that such policies have always been dependent upon solid Government/Industry teamwork and shorter overall acquisition cycle time. Various underlying impediments in the defense acquisition process have worked at cross-purposes to these needs over the years and can again impede the new DoD-5000 initiatives.

We have identified some of the main obstacles to effective Government/Industry teamwork, as well as reasons for today's long acquisition cycle time. The teamwork impediments include a group of solicitation and contracting practices, which have caused characteristics from the fixed-price-development era to linger during the award and management of new programs. These have also combined with recent legislation to chill worthwhile cooperation during the pre-award period. Even the new DoD-5000 drafts convey a guarded approach to teamwork with Industry; including guarded cooperation on the IPPD/CAIV initiatives where solid teamwork is essential.

As to the long overall cycle time, today's acquisitions are driven principally by the pipeline nature of the many phases, anchored around drawn-out EMD phases.

The impediments to Government/Industry teamwork can be overcome by adoption of a pro-active roadmap, or trust-model, for Government and Industry to cooperate on the implementation of the new DoD-5000 policies. Although this can also help shorten today's long acquisition process, thoughtful consideration is also needed to making a major improvement in cycle time.

We propose the following strawman approach which can both represent a roadmap for teamwork and permit a system development process on the order of 3-5 years. By combining proven practices from successful military and commercial programs with team-based execution of the CAIV/OIPT principles, this approach replaces today's long, multi-phase process with a much shorter cycle. Industry and the OSD should work together to implement the details of this approach in implementation of the new acquisition policy documents.

DoD and Industry jointly should give thoughtful consideration to making watershed changes to shorten the process. Such changes need not be risky or unproven. A body of "lessons-learned" is available from successful military and commercial programs upon which to confidently structure a new process. Indeed, the use of integrated product development, combined with modern concurrent engineering and precision manufacturing tools, could permit a version of the recent ACTD concept to be the new acquisition norm, with a 3-5 year development cycle including initial fielding for user tactics and doctrine.

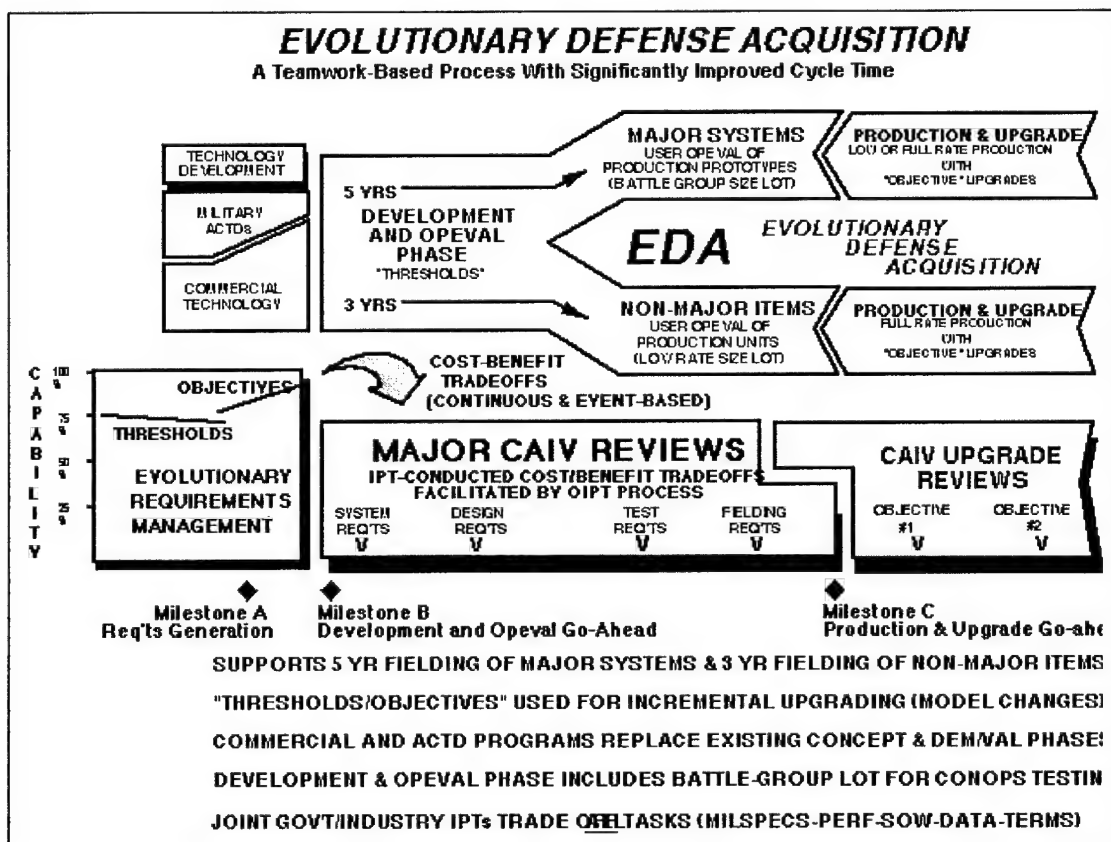
Such a new process, entitled "Evolutionary Defense Acquisition" (EDA), is summarized in the following section. It preserves and enhances the CAIV principles and the necessary teamwork outlined in earlier remarks, but replaces today's multi-phase cycle with a much shorter process. To provide a basis for full examination of EDA, implementation specifics are also set forth along with some of the key lessons-learned programs from which information was taken to formulate the process. Although there are actual recent programs used as models to form the EDA concept, the approach should also be "piloted" on a few programs for validation.

## **Evolutionary Defense Acquisition**

Existing DoD-5000 phases could be replaced with a process using 3 to 5 years to develop and field systems in step with modern technology cycles. It would focus on mainstream US defense needs into the next century, including precision weapons, C<sup>3</sup>I, information warfare and technology upgrade to existing aircraft, ship, battlefield and space systems.

The new process could be called "Evolutionary Defense Acquisition" (EDA), stressing an intent to replace today's culture with an affordable, incremental approach. The baseline for Major System development would be 5 years, including fielding and user Opeval of a battle group size production prototype lot. The Opeval would establish concepts of operation, tactics and doctrine for single and joint service use, determine readiness for full production and affirm the next level of required system growth. Equally important, the battle group prototypes would serve as a quick reaction warfighting resource, sustaining a modern, economic American defense structure and guarding against defacto disarmament under budget downsizing. The baseline for development of Non-Major Items would be 3 years or less, including fielding of a low-rate production lot for similar Opeval and contingency warfighting uses.

EDA would be built around an incremental approach to operational performance. "Threshold" requirements would apply to the initial battle group prototype or low-rate production fielding lots, with incremental "objectives" introduced later as system upgrades. The threshold would represent the minimum operational performance with current technology to make an initial system fielding, while the objective level would represent longer term goals which may be upgraded into the system in pace with evolving technology. These requirements would be managed using CAIV tradeoffs at milestones throughout development and Opeval to keep performance and cost in balance, avoid grand design systems, and mitigate program risk.



## EDA Implementation Details

### Technology and Requirements Validation Before System Development

Rapidly paced commercial subsystems can provide varied, economic technologies for many Non-major Items and some Major Systems; while independent contractor R&D and Advanced Concept Technology Demonstrators (ACTDs) can rapidly prototype defense-unique technologies or integrate commercial subsystems for complex defense uses. The



cycle time and better understood performance/cost characteristics of these technologies will also permit firmly planned thresholds and incremental performance objectives.

#### Acquisition Milestones and Approvals

EDA would use three decision milestones. Milestone A, Requirements Generation, represents provisional approval to begin a new program. Milestone B, Development and Opeval, commits to a new development inclusive of a battle group production prototype lot for Major Systems or a low-rate production lot for Non-Major Items, including Opeval testing of these. Milestone C, Production, commits to the approved production rate together with a plan for incorporation of the incremental grow-to upgrades at block change points.

#### Competitive Source Selections

Under EDA, there would be one major competition for the “Development and Opeval Phase.” BAFOs and risk-averse awards would be replaced with selections based on the first principle of EDA—best balance between performance, cost, and schedule.

#### Concurrent Engineering and Precision Manufacturing Technologies

Concurrent engineering and precision manufacturing technologies will be used to ensure that both the production prototype and low rate production lots under EDA are manufactured with virtual-production cost effectiveness, quality, and operational fidelity.

#### Contracting Structure

The contracting structure for EDA would be patterned after the black, X-model, and commercial programs described below. Cost Plus Incentive Fee/Award Fee contracts should be designed to incentivize balance between performance, cost, and schedule.

#### Acquisition Teamwork

EDA would use lean Integrated Product Teams, made up of acquisition and user experts joined by Industry development experts; all focusing on continuous cost benefit tradeoffs to balance performance, cost, and schedule. Empowerment would be within the IPT, subject to corporate-type Delegations of Authority. IPTs would also manage Opeval testing, using non-organic contractor logistic support until full production. IPTs would avoid costly subteam structures or management tools contrary to the streamlined EDA contracting approach above.

### Past Successful Practices

Successful management practices from recent military and commercial developments have been drawn upon to help define EDA. A highly successful black system, a missile defense system, an X-Model airplane, a new commercial air transport, and an advanced technology electronics item have been selected because their successes are most relevant to EDA:

- F-117 Tactical Fighter - This program has become a hallmark of successful acquisition practice. During a brief period in the 1980s, this highly advanced system was developed and fielded as a 59 aircraft wing, typical of smaller battle group deployments likely in the future. Operational requirements focused on a short list of three principal characteristics—stealth signature, range, and weapon accuracy. These were constantly traded off to foster heavy use of existing F-18, F-16 and F-15 subsystem assets, permitting funding to be focused on the new stealth technology. The development and fielding cycle was very short; non-value technical, management, and financial reporting was excluded; and long term funding stability was emphasized to avoid year-to-year incremental funding disruption.
- Theater High Altitude Air Defense (THAAD) System—THAAD uses DoD-5000 phasing in a relatively positive way. During Phase I, an initial missile defense capability to combat today's basic threats is fielded for user operational evaluation. Phase II is to develop system upgrades for expanded capability. THAAD's strategy is important because it breaks away from the grand design culture for basic fielding and shortens development cycle time.
- X-31 Aircraft—This fine cooperative effort between the US and Germany used barebones funding, contract tasking and solid teamwork to fashion the first new X-Model program in decades. It was managed using approved "contractor plans" and, much like the F-117, it uses existing subsystems in areas not critical to its advanced combat aerodynamics.
- 777 Transport—This new air transport uses technology for incremental performance growth, affordability, safety and passenger comfort; rather than a grand design leap in capability. Emphasis on long term supplier relationships achieved unprecedented reductions of lead time to less than a year; not on counterproductive recompetitions or second sourcing which cause data rights issues and preclude long term logistic support/maintenance by the original team. Oversight and reporting is principally to support FAA inspection and safety needs.
- Precision Location GPS Receiver (PLGR)—This 17,000 unit program is a fine example of the use of commercial practices on a military requirement. The contractor developed the equipment outside of the DoD-5000 process and the production offer permitted the Government to either reduce or eliminate DoD-5000 mil-specs, standards, data clauses, and overhead cost. Reductions within the procuring agencies

authority provided 20% savings and full elimination of DoD-5000 requirements would have provided a 37% savings.

## **Appendix I**

### **International Cooperative Opportunities White Paper**

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# **International Cooperative Opportunities White Paper**

## **Proposed Acquisition Teamwork and Cycle Time Improvements**

National Center for Advanced Technologies  
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Washington, D.C. 20005

30 October 1996

### **Background**

At the request of Dr. Spiros Pallas, an ad hoc team of the Industry Affordability Task Force, under the chairmanship of Mr. Mike Robinson, Rockwell North American, met to discuss potential participation in a Under Secretary of Defense (Acquisition and Technology) (USD/AT) initiative dealing with International Cooperative Opportunities. Seven companies (ranging in product from ground vehicles to avionics, electronics, engines, and airframes) were represented. All agreed that the end result of this get-together would be the preparation of a draft white paper to be coordinated with the balance of the Task Force prior to delivery to OSD.

International Cooperative Opportunities is a concept, initiated by the USD/AT, to jointly develop requirements with other nations, with European Allied nations at the outset, and potentially globally. The concept is derived from a US study completed in the Spring of 1996, which indicated that joint requirements activities between the allied nations was "meager." Additionally, while there is good cooperation between Governments in international armaments activities, and there are some company-to-company activities, the process of sharing requirements jointly is not very well formulated.

The initial discussions of the group revolved around the reaction of the companies to the fundamental concept of participating with offshore Governments and companies in the early identification of mutual armament requirements. A point paper to stimulate the conversation was distributed prior to the gathering (attach 1).

The general sense of the participants was: International Cooperative Opportunities could be fundamentally a good concept, given the imploding state of the Nation's Defense Industry, the rapidly diminishing defense budgets, and the world armament market situation, if the significant barriers can be surmounted. All of the representatives agreed that the environment in which their business is conducted has substantially changed in the recent past, and was very likely to continue to change. Both foreign and U.S. companies are competing for greatly shrinking defense investment resources. Because of this, more

innovative ways of conducting global commerce, fitting both the defense needs of the US Government and the business needs of US companies, should be investigated. They also agreed that the environment within the DoD is becoming more receptive to Industry input and recommendation, with Industry becoming more of a partner in the defense decision making process.

## **Barriers to International Cooperation**

1. The largest impediment to a successful program of international cooperation is the United States defense requirements process itself. Even in today's more cooperative environment, US Industry typically does not share in the requirements generating process. While individual programs can be cited that belie the previous statement, Industry is told that requirements definition is "the warfighter's domain," and Industry need only to be reactive to them. The insight of the members of the ad hoc team into the foreign requirements definition processes—particularly in Europe—on the other hand, shows that foreign Governments and their industries work closely throughout the requirements process, forming a unified country position from the outset. The impact of attempting a joint Government-Industry international requirements definition with these divergent philosophies would at best result in:

- The European parties showing up with a solid agenda,
- The U.S. Government with a desire, and
- U.S. Industry attending to find out what is going on.

The result of that situation cannot bode well for U.S. interests. Thus, with those facts in mind, prior to any further pursuit of an international program, the model for Industry participation in the US defense requirements process must be redefined.

2. A second barrier is the potential reluctance of the operator/warfighter to participate in a program that would diminish the technological fighting edge he has enjoyed over the past decades. Convincing the warfighter to share tactical advantage with peers, even be they allies, is a consideration that must be addressed before approaching Europe.

3. Once the domestic requirement process is ironed out, proceeding to the next step of international sharing could be best met by dealing with the Europeans on a multilateral basis rather than a bilateral basis. The rationale behind this idea is simple. In the U.S., multiple companies with similar product lines have traditionally acted in competition with each other, vying for the global defense market. European companies are usually singular entities within their respective nation, dealing closely with their Government, with little or no intra-country competition. Competition in the European scenario is evolving to an inter-country, e.g., British Aerospace competing with DASA or Aerospatiale to become the "kingpin of EU defense." Thus, multi-lateral dealings would place the European Industry in a similar competitive position as the U.S. Industry, and a level playing field would result.

## **Concerns**

There is a concern within U.S. Industry that the Europeans might gain a significant advantage over their U.S. counterparts if the initiative is pursued without a closer partnership between U.S. Industry and U.S. Government (USG). One member of the group felt the initiative could be a unilateral opening of the U.S. market. If in fact this were true, it could be extremely detrimental to the U.S. armament Industry. It therefore becomes extremely important for U.S. companies to have a greater role in the requirements process, and in the planning and execution of the ICOG initiative, prior to the initiative gaining momentum.

While technological parity is not a prerequisite for exploring joint requirements, there needs to be a clearer picture of what are the European industries' plans and motives in participating in this initiative. For example, two questions (which equally apply to both sides of the equation) must be answered with regard to the participants. Will the Governments be willing to invest significantly increased R&D funds to participate as full partners? Will the companies be willing to take secondary roles if their capabilities are not equal to the task of being the program prime? The answers, however important, are still predicated on the USG and the US Industry operating in a closer relationship.

## **Potential of Cooperative Opportunities**

The potential of increasing markets to US companies is significant enough to pursue this concept to its fullest.

1. Countries and companies within the EU are tending to focus their activities within the union at the exclusion of the U.S. This initiative could keep the European doors open. However, it must be recognized from the out set that the U.S. will become a partner (and not always the senior one) in the new systems that result from the requirements.
2. The dream of interoperability may become a reality as a result of this process.
3. Dealing with the Europeans on a multi lateral basis will:
  - Provide the largest market potential for products that will result from their requirements. This is good for both Industry and Government as increased sales potential while lowering both acquisition and operational support (because of interoperability) costs.
  - Provide room for multiple U.S. companies to participate and compete for the resulting products. This is because U.S. competitors will have multiple industrial teaming opportunities. (e.g. U.S. company A teams with British aerospace while U.S. Company B teams with Germany's DASA).
  - Be more acceptable to European Industry by allaying the fear that either a U.S. giant will totally overwhelm them or another European company will gain advantage over them in becoming the EU kingpin.



4. While there was some concern voiced about technology parity, or technology transferring during the requirements phase, this concern was considered to be not significant, as long as the company had ultimate authority and control over the dissemination of technology (proprietary information). The benefit of technological intelligence would probably gravitate to the US companies, and outweigh any technological intelligence traveling the other way. For the most part, technology transfer typically does not occur early in the requirements phase of weapons systems acquisition. Technology transfer, however, could potentially become significant later on in the acquisition. Therefore, any insight gained by U.S. companies into the U. S. requirements process will be beneficial when dealing with EU industries, in understanding their state-of-the-art, and by providing knowledge and time to protect U.S. competitive edge in the product development phases. Current barriers to US companies trading with offshore Governments would have to be addressed. The traditionalists within the DoD would have to be assuaged (i.e. contracting vehicles, export control, Acquisition Reform, Military Specifications would have to be addressed). On the European side, the capability (and will to increase capability) to become an equal partner will have to be addressed.

## **Next Steps**

1. It is suggested that an Industry-Government workshop be held to examine and structure a new US requirements development model that includes Industry as a partner. A broad based Industry group (air, sea, land, hardware, software, mechanical, electronics, propulsion) could be formed to interface with Government (DoD, State, JCS J-8) and service requirements organizations to work this issue. It might be beneficial to identify three or four programs at various stages in the process to serve as models rather than solve the issue totally. It will take strong, clear, leadership from OSD to overcome long established territorial boundaries to accomplish this task.

2. It is suggested that a follow on Industry-Government workshop to examine and identify the most appropriate interface in Europe (NATO, EU), and how it would best be used to facilitate the international cooperative program (venue, format, program level, participant level). Additionally, an examination of what EU activities and changes should take place to assure a balanced approach to requirements sharing. A review of what have been the past impediments to true cooperation would be a good start in this activity.

3. It is suggested that a parallel activity, or a close follow-up program of international cooperation proceed with Pacific Rim nations. This is because, with the possible exception of Japan, the countries are less amalgamated than in Europe. They see a more urgent threat and have funds to pursue new programs.

## **Appendix J**

### **An Industry Perspective of the COSSI Program**

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**An Industry Perspective of the  
COMMERCIAL O&S SAVINGS INITIATIVE (COSSI)**

**31 JANUARY 1997**

**DUAL USE APPLICATIONS PROGRAM**

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## Overview

The Department of Defense, through the Dual Use Applications Program Office, recently initiated a novel program to help reduce the operations and support costs of existing, fielded weapon systems. The program, entitled the *Commercial Operations and Support Savings Initiative* (COSSI), was formally launched with a January 15th, 1997 announcement and solicitation to the private sector to respond with proposals for evaluation and subsequent award. Preliminary discussions with Industry representatives participating in the Multi Association Industry Affordability Task Force at NCAT prior to the issuance of the formal broad area announcement and solicitation, helped to formulate the concept of the initiative.

There has been a lot of activity in defense acquisition reform in the past four years. Many of the sacred cows of defense acquisition have been put under the strong light of "Necessity" focused by a lens of declining defense resources. A lot of changes have resulted. Specification reform, the Single Process Initiative, Cost vs. Performance Trades (Cost as an Independent Variable), and Integrated Product/Process Development, are a few of the sweeping changes that have been successfully initiated. Regulations and directives have been discarded or re-written (DoDD 5000.1 and DoDI 5000.2). In many of these reforms, the voice of the Industry was sought and listened to. More importantly, many of the ideas of the Industry component have been accepted and incorporated in the changes. Most importantly, these comments and reviews were sought prior to the issuance of new direction; an unprecedented reliance on the partnership of Industry and Government. The environment has been one of clear receptivity to suggestion on the part of the department, and one of eager participation on the part of the Industry.

The COSSI program is designed to develop and test a method to reduce operations and support costs of fielded military systems by inserting commercial technologies (products and processes). The concept underlying this initiative presumes the use of proven commercial products and processes which require less development, special equipment, and test costs and which will reduce the cost of operating and supporting the overall fielded system. It also supposes that the capability, reliability, and efficiency of the system will, at the minimum, remain the same.

On balance, the program is innovative. It attempts to bring a fresh, new perspective to the world of defense acquisition. Lowering O&S costs being the primary motive, the traditional decision process will be changed by the COSSI. Based principally on the typical commercial activity of the "business case" the initiative shifts Profit & Loss (P&L) risk directly to the company. The concept of "product value pricing" versus "cost based" activity, shifts acquisition decision risk directly to the Government acquirer. The decision to buy goods and services will now be based on price and best value alone. These ideas, new to defense procurement, are imbedded in other innovations and trial programmatic ideas, which (if acceptable to both the defense community and the Industry) could change the way the traditional defense acquisition system operates. However, there still exists a modicum of skepticism on the part of the Industry because of

traditional acquisition practices. This paper will attempt to point out the skepticism and remedies as it weaves through the issues.

## **Comments**

### **General**

The COSSI program incorporates a fast track solicitation, teaming, response, evaluation, and award of a two stage process. The first stage involves a company forming a team of respondents (one of which needs to be a for profit company). A proposal to provide a prototype of a component, product, process, software, or service, using commercial technology in the form of processes or products that will be imbedded in a system or subsystem, is then submitted. Incorporated in the proposal is a business agreement and a price for the subsequent production run, delivery and installation of "kits;" this is the second stage of the program. "Kits" are defined broadly, and could incorporate open commercial standard items (viewed more favorably in the proposal evaluation) as part of the solution, but could include a product or service that is either "for sale" commercially or is "just about to become commercially available." The program is open to all companies, large and small, and addresses only existing systems in the field. Industry fully supports this general concept.

### **O&S Savings vice S&T**

This part of the Dual Use Applications Program, the COSSI, is targeted at reducing the operations and support costs on existing systems. Industry has actually been waiting for such a program and applauds the effort to dedicate resources to develop commercial technology insertion programs in existing fielded weapons systems. Sustainment has been an issue receiving greater attention in Industry. Providing solutions to diminishing manufacturing sources and the rapidly growing number of obsolescent parts could get a big boost from the intent of the COSSI program. The use of commercial parts and processes could alleviate the need for lengthy development and costly test & evaluation programs if pursued according to the planned initiative. However, there is Industry concern regarding the total acceptance of commercial technology insertion. Once a Phase I program development is bid and proposed, there is some concern that there might be attempts to conduct further EMD level development in Phase II to address certification, testing, and qualification requirements. Companies are concerned that Government agencies may insist on traditional certification and qualification routines that could drive costs higher. This type of addition to the program should be avoided. The intent of the COSSI program is to save O&S costs using existing commercial technology, therefore re-certification of platforms and subsystems because of the insertion of commercial parts would reduce or even eliminate any savings.

## Cost Sharing

Normally one of the more controversial and least accepted parts of any Government program is the idea of cost sharing. Of course, it is a good way for the DoD to leverage its diminishing resources. In the case of some programs that result in substantially "defense unique" products, cost sharing provides little incentive for the company participant. The unpopularity of cost sharing increases as the formula for sharing becomes more proscribed. For example, a specific per cent cost share mandated for entry into a program would likely result in less company participation. The COSSI, with its flexible cost share, provides a better incentive to company participation than other cost sharing programs because the percent of share can be calculated with the attendant risk and payback to both parties, then proposed as part of the total program, and accepted or rejected by the customer. Since Independent Research and Development (IR&D) accounts can be used by companies as an application of resources in the cost share, one would expect the companies to use this avenue to its maximum. The Government, on the other hand, would probably see greater "faith" and confidence in the proposal if "cash" were offered as the cost sharing offset (more faith being displayed as the percentage gets closer to a shared "fifty-fifty" proposition). The flexible cost share of the COSSI program is seen as a factor that will allow for real competitiveness of participating companies as they put together their proposals. From the Government's point of view, one of the discriminating factors of the selection process will be "how much is the company willing to put up front?" Covering the cost of bid and proposal, development and kit research and packaging with some portion of company money leveraged by the balance of Government funds is an attractive business proposition to many companies. However attractive, there remains a good deal of skepticism that the good deal will fall apart when the proposal gets to Phase II. Every attempt must be made to assure that programs continue through both phases.

There are separate issues regarding IR&D as a potential source of resource sharing. From a company perspective, IR&D funds have become very scarce for new program use. Using these scarce resources in projects without substantial payback will be hard to sell to the company leadership. Investing IR&D resources in a small program without apparent outyear support will not be a likely competitor for internal Industry funding. Cost sharing IR&D could refocus these company resources into areas and directions other than originally planned. The reluctance to use IR&D as a source is heightened as it becomes apparent that phase II continuance weakens or commercial technologies evolve in directions different than anticipated for the project.

The likelihood of cash being offered for cost sharing is also a problem in the aerospace Industry today. While the profitability of aerospace is up in the past year, the consolidations recorded in the Industry today could lead one to assume that companies will be loath to apply cash resources to any share ratio program if the outyear recoupment is unclear. Given both sources of resources available, companies will probably opt more for the IR&D application of the cost share spectrum. The Dual Use Program Office, however, has continuously leaned more toward cash contributions. An in-depth dialogue to discuss cost sharing expectations should be expected at the bidders' conference. What

should be remembered in all of these discussions is the underlying reason for the initiative, the reduction of O&S costs.

### **Other Transactions Authority (OTA)**

The DARPA "Other Transactions Authority" (Section 845 of the FY 1994 Defense Authorization Act, and Sect 804 FY 1997 Defense Authorization Act), used as the vehicle for pursuing Phase I, provides an ideal situation for trying out the COSSI concept. Operating with more flexible contractual vehicles will cut proposal process time, and the attendant company costs of getting on contract. The flexibility afforded by the OTA will also allow concentration on aspects of the initiative with which companies have more concerns, such as: negotiations of the business case, agreements of proprietary rights, service agreements, warranties, guarantees etc. Since not many companies have done any Government business within the guidelines of the other transactions vehicle, it might take some time for a degree of comfort, and confidence with the non-FAR apparatus to develop. There are some concerns regarding the non-traditional phase I OTA being followed by the traditional FAR contracting processes in Phase II. The COSSI intent is perceived to be a straight fixed price purchase of kits and services made according to the business agreement agreed upon in Phase I. The Industry skepticism is: the Government auditor and overseer will still require cost based information during Phase I, and in production (Phase II), there will be a requirement for in-process specification review.

### **Service Involvement**

Individual service program manager "buy in" as a team member was originally proposed during discussions as part of this initiative but is not seen in the BAA. A Government team member participating "up front" in the process would be an outstanding method to insure total support by all the stakeholders. Weapon system O&S programs have traditionally been fragmented in support, usually suffering reduced resources as budget is used for other contingencies. Bringing the weapons system program manager into the COSSI program early, as originally proposed, would have increased the likelihood of successful program initiation and continuation through Phase II commitment. There is concern that Phase II continuations may not occur because of funding constraints or lack of dedicated resources to fund the second phase of the program. The concern is valid. It must be recognized that the COSSI business cases submitted by respondents will be built based on the assumption that both phases do occur, and Phase II does contribute to the offset of resources applied in the development stage. It appears that the majority Industry viewpoint is this: involvement of the program office as a COSSI program team member is the best assurance of program stability and will lower the risk of a Phase II not occurring. From the Government perspective it should be obvious that programs incapable of being funded for the second phase will not survive the process, unless the service is a team member, the final evaluator, and funder of the kit insertion in Phase II. The clear identification and participation of the specific military customer, and the support for the proposed follow on Phase II "kit" provides a strong incentive to



participate in the COSSI. If a significant number of "Phase IIs" disappear due to change of support, mission, or revised budgetary priorities after the completion of Phase I, the credibility of the COSSI will be substantially damaged.

The timing of the initiative with respect to Phase I and Phase II insertion also warrants some attention. For large dollar programs, it may be financially imprudent for a company to commit appropriate resources for cost sharing considering the fact that obtaining commitment from the services will most likely require two years after Phase I startup. This could have a chilling effect on proposing more ambitious programs that are potentially capable of producing significant O&S savings.

### **Cost Vs. Price**

Lastly, the transition from cost based contracting to price based purchasing appears to many on the Industry side to be the most significant change to overcome. It is unclear how the Government intends to establish a "fair and reasonable" basis for determining kit prices as it relates to projected O&S savings. Kits requiring significant non-recurring engineering (NRE) and other non-commercial costs in the "wrapping" for fielded system insertion will be difficult to analyze. While not required by the program, nor mentioned in the BAA, there is some concern that the provider will be requested to provide cost and pricing data to support the Government customer analysis. There is some Industry skepticism that the Government customer will be able to complete an analysis of price without additional information from the provider. The concern evolves around the notion that the customer will inevitably find themselves in the position of asking, "what is a reasonable amount of profit for the contractor to make based on their cost of development?" Unfortunately, that notion is contrary to the intent of this COSSI initiative. Commercial Industry relies on price based purchasing where competition for market share, good product ideas, and best value purchases drive prices to a "fair and reasonable" level. Government customers will have to recognize this as a normal way of doing business. The COSSI experiment seeks to implement defense acquisition in more of a commercial model than the past; price based purchasing decisions for the Government buyer should logically follow suit.

### **Summary**

There are a number of new ideas embedded in this initiative that received close scrutiny and discussion. Further Industry examination, continued review and comment, and certainly full and open participation between Government and Industry is necessary as the program evolves. These new ideas warrant close tracking by Industry and Government to insure that the successes are institutionalized and the pitfalls and "blind alleys" are catalogued and avoided in any future iterations of the program.

While the COSSI effort is addressing the shorter term issue of the DUAP program, there is a longer term component that must be infused into the DoD S&T program. The NCAT

Multi-Association Industry Affordability Task Force, which provided the input for this White Paper, is ready and willing to continue the dialogue for the S&T portion of the program and to address any future activities in the COSSI program that might catalogue lessons learned or pitfalls to be avoided.

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# **Appendix K**

## **Sustainment Report**

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**THE NATIONAL CENTER FOR ADVANCED TECHNOLOGIES**

# **Sustainment**

**Report of the**

**SUSTAINMENT TEAM**

**of the**

**Industry Affordability Task Force**

**The National Center for Advanced Technologies  
1250 Eye Street NW  
Washington, DC 20005**

**Report Number 98-SS1A**

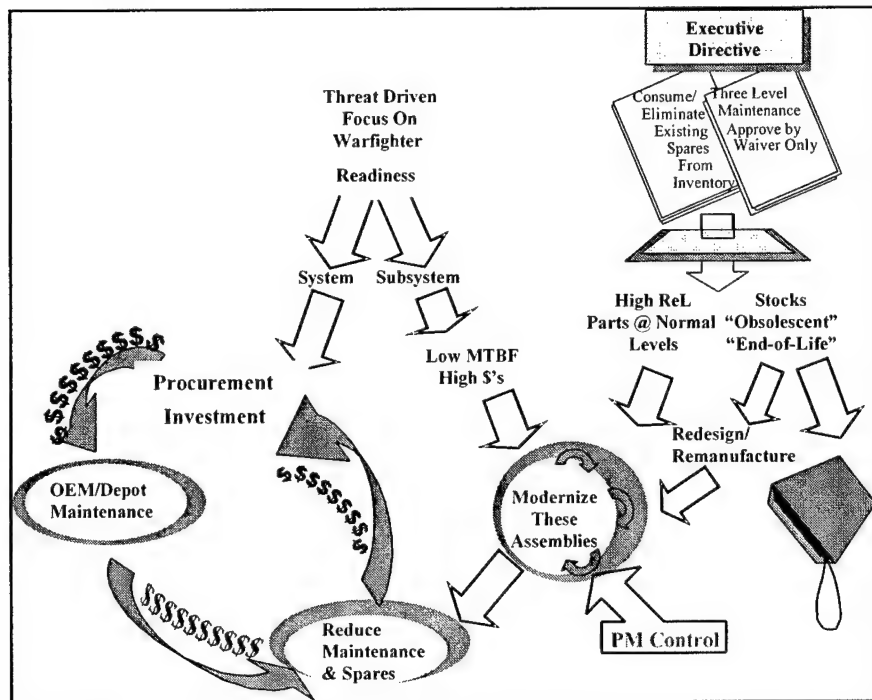
## Executive Summary

It is time that bold actions be considered by the DoD in a serious attempt to significantly reduce the growing sustainment costs and thus shift funds to new procurement. This paper describes some actions proposed by the “Sustainment Team,” which was formed with Industry experts from within the resources of the Industry Affordability Task Force (IATF) of the National Center for Advanced Technologies (NCAT). This team proposes a process that would transition DoD from the present “Vicious Cycle,” where deferred modernization means that O&S consumes increasing resources and thus prevents modernization, to a more “Vital Cycle” that would reduce the sustainment costs of legacy systems, and provide for modernization of weapons systems. Pursuing the “vital cycle” came with one caveat: any action taken could not adversely effect warfighters’ capabilities.

The recommendations lean heavily on using commercial practices and suggest improvements in reliability/maintainability through Industry-DoD partnering. In perspective, the core competencies of Industry and DoD are different. DoD has a long history of maintaining systems, abet not at the lowest cost or cycle time. The private sector, however, has built a core competency in both maintaining and improving system components because of different incentives: reducing the costs of warranties and the high cost of defective products.

Generally, the recommended process, shown below in Figure 1, calls for:

- Changing the concept of maintenance from three levels to two levels, except by waiver, and utilizing commercial-depot competition for lowest cost and time.
- Depleting current inventories of low-reliability spares while ordering improved components.
- Reducing sustainment costs by selectively identifying high-cost and low reliability components for Industry improvement through total ownership responsibility.
- Applying commercial business decision filters to the support mechanisms of legacy systems.



**Figure 1. The recommended process for pursuing the “Vital Cycle”**

An executive directive, coming from the Secretary of Defense, would be required to effectively jar this process to a start. The directive, similar to the order that curtailed the use of MILSPECs, would curtail further procurement of low reliability, high cost driver spare components and require the competitive sourcing of improved, warranted components. The climate for this sort of bold action idea is favorable. The Defense Systems Affordability Council (DSAC) recently issued goals outlining the levels of improvement to be sought, and actions preferred to achieve them. This paper is in concert with many of the ideas of the DSAC Goals.

**Goal # 1 - Field quality defense products quickly and support them responsively**

**Goal # 2 - Lower TOC of Defense Products**

**Goal # 3 - Save O&S and Infrastructure monies & move these savings to modernization efforts/accounts.**

**DSAC Goals for 21<sup>st</sup> Century**



There is no question regarding the importance of the goal of shortening of the cycle time of defense acquisition. The idea's time has come. Considering the nominal twenty-year cycle that is prevalent in defense acquisition, a 50% reduction (ten years) is certainly an improvement. However, even greater reductions are possible. The Evolutionary Defense Acquisition (EDA), currently resident in the DoD acquisition desk book, models the development to IOC of a Major System in 5 years, including fielding and user operation evaluation of battle group size production prototype lots.\*\* For new systems the compressed acquisition cycle takes into account the corrections needed for their sustainment. This paper deals principally with the sustainment issue of legacy systems and is complementary to the EDA, and also in concert with the DSAC goals in addressing a revolutionary approach to solving the sustainment problem by re-engineering the logistic systems.

Re-engineering the logistic system requires drastic departure from the classical logistic functions. But if it is the desire of the DoD to embrace the ways of the Commercial Sector, then little re-invention of the defense infrastructure need take place. A quicker method of achieving the goal would probably be to totally outsource it to one or a number of existing Commercial "off-the-shelf" operations instead of spending the time and resources modifying the existing DoD system.

However, significant culture change is required for these mechanisms to result in real, sustained improvements. Lowering total ownership cost and allowing funds to shift from infrastructure to modernizing can only be accomplished if non-traditional provisions to allow the migration are made. Traditionally, "cost savings" and "cost avoidances" do not "flow" back to the individual program nor to the major force program account, but are captured by the general account or go back to the Treasury. This revolutionary change requires assistance through legislation. The lag time for improvements to be recognized relative to the modernization of fielded weapon systems require time periods longer than normal government personnel rotational periods. System Program Management leadership will have to be in place for longer periods of time, and this will be a major

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\*\* Evolutionary Defense Acquisition, The National Center for Advanced Technologies, 1996

cultural change. A commitment of this level for a uniformed member of the DoD has major career implications, which need to be recognized. Adequate career advancement opportunities must be made commensurate with these sacrifices.

The politics attendant to the military depots must also be dealt with and eliminated if the Vital Cycle is to succeed. Where military depots have critical core competencies relative to specific weapons systems, they must be capable of partnering with Industry or subcontracting to Industry at competitive prices. These depots cannot be protected "at any cost" using political manipulations, that action would negate any gains and thwart the competitive nature of cost reduction actions.

Additionally, an increased exchange of requirements information between the services and the Industry must take place to enable the effective use of private sector Industry in the integration of the commercial/military industrial phase. Future requirements and systems needs must be articulated to round out the total picture of technologies needed to maintain our warfighter "decisive edge." Not all defense program managers and their Industry counterparts know where technologies are and what specific technologies are needed to solve particular defense problems. These communities will have to share in the information and knowledge early enough to effect systems conceptualization and development.

Passing title of legacy systems and/or their components to original equipment manufacturers should be considered as a method to allow the "freeing up" of resources from infrastructure and support. These type of "power-by-the-hour" arrangements can significantly reduce O&S infrastructure costs. This is by far the most significant revolutionary idea that requires complete paradigm change. Passing ownership to a company and contracting for a service-based requirement fulfillment arrangement can result in immediate cost savings from infrastructure reductions, followed by sustained cost reduction through Industry improvements.

This paper illustrates how these revolutionary ideas might work within the DoD system. Actual examples of how these ideas are working for both Industry and Government are

given. The success of the ARC-210, the Caterpillar Alliance, and the "Power-by-the-Hour" concept, initiated by the propulsion companies in their support of the commercial airlines, are provided with supporting data. Direct Vendor Delivery (DVD) is a concept of Contractor Logistics Support (CLS) that has been recently implemented in three different contracts.

Notwithstanding the revolutionary ideas espoused in this paper, there remain many major barriers that must be overcome before any progress is to be made. It will take bold decisiveness to start the action and non-parochial decision making to follow through. The bottom line to all of the ideas presented in this paper is this: the warfighter must not be put at risk but be the beneficial recipient of any change in method or policy that effects this paradigm shift. The adoption and execution of commercial business practices is an outstanding objective, but will require major efforts of partnership and trust with Industry and Government as key participants. We suggest continued participation of Industry teams in the formulation of these goals and executing plans.

## Introduction

Recognizing the necessity for providing an Industry viewpoint to the issue of sustaining the military forces systems in a business like way, the National Center for Advanced Technologies (NCAT) chartered a team within the Industry Affordability Task Force to examine the situation and report recommendations. This paper reflects that activity, the outcome of the team's deliberations, and the recommendations offered to the Executive Committee of the Industry Affordability Task Force. The team was made up of Industry representatives, and chaired by Mr. Ted Pertowski of GEC Marconi.<sup>††</sup> Team members were selected based upon experience in commercial or DoD sustainment processes, and represented a broad section of Industry. The objective of the team was to focus particularly on the "Support" issues incorporated in "Operation & Support" cost. Based upon previous team results, this team would seek to identify potential solutions, assist in the identification of resources needed to improve sustainment technologies, and help to identify sustainment technologies as they apply to procurement of new systems.

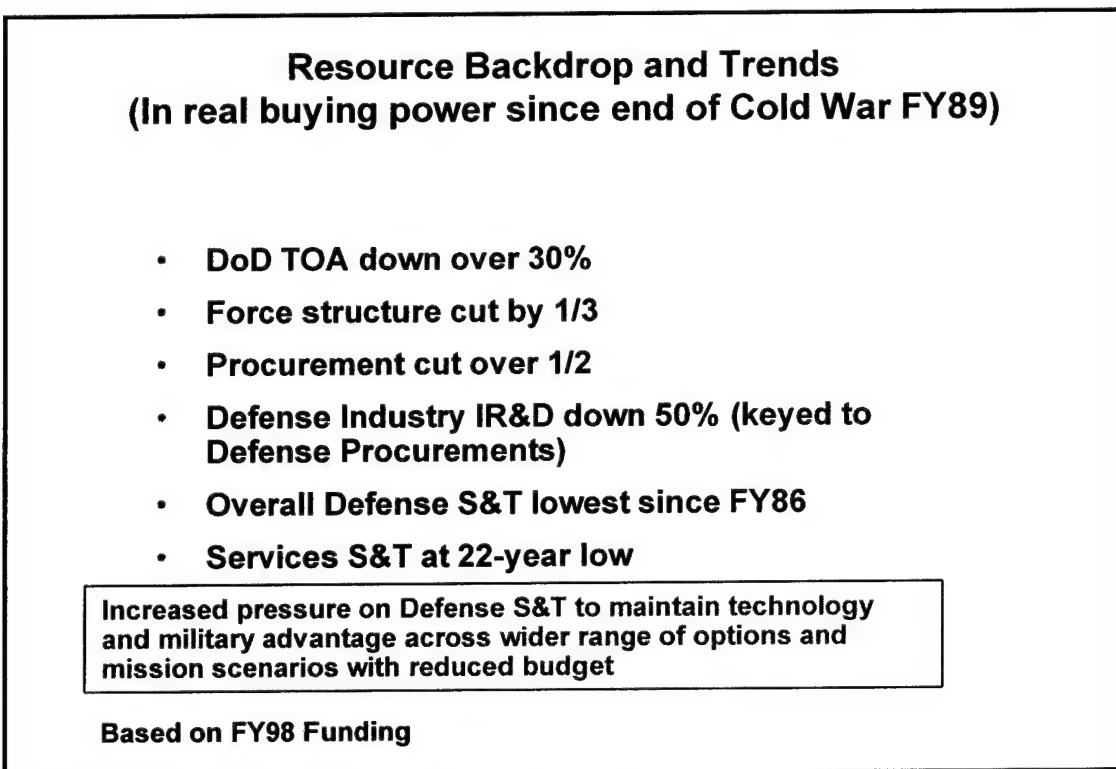
The team created a draft charter<sup>††</sup> which was presented to and approved by the Executive Committee of the Task Force. In general terms the team was to conduct a thorough examination of weapons systems' sustainment with the aim of identifying barriers, cost drivers, and issues confronting Industry in their attempts to reduce sustainment costs, then extrapolate this information to the situation confronting the Department of Defense today and present the findings as an independent, unsolicited Industry review of the sustainment issue. In addition, the Task Force Executive Committee sought information which could possibly provide methods for reducing the growing cost and effort of sustainability by identifying high cost drivers of major weapons systems, determine what portion of those costs could be effected, and identify the barriers or innovative solutions for reducing or eliminating the high cost area. The final report of this analysis effort would be made available to the decision-makers in the Department of Defense in the form of plans or recommendations. The process decided on and followed by the team is at Appendix 4.

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<sup>††</sup> Team membership listed at Appendix 1

## The Problem

While there are many facets to the “support” issue in terms of “operations and support,” the team saw the real problem as the degradation of “Readiness.” Readiness as defined by this team was the ability of our armed forces to carry out their mission unimpeded at the current operations tempo and the current funding levels. In the recent past (prior to 1989), funding resources were not an issue directly impacting readiness. There were issues of timing, stability, earmarking, and efficiencies, but the forces did not suffer any loss of readiness. During the drawdown from 1990 to the present, modernization funds were severely reduced. Operations and Support activities resulting from increasing deployment activity worldwide and the ever-aging fleet siphoned off resources from the services dwindling Total Obligation Authority (TOA).



**Figure 2. Resource Level Changes**

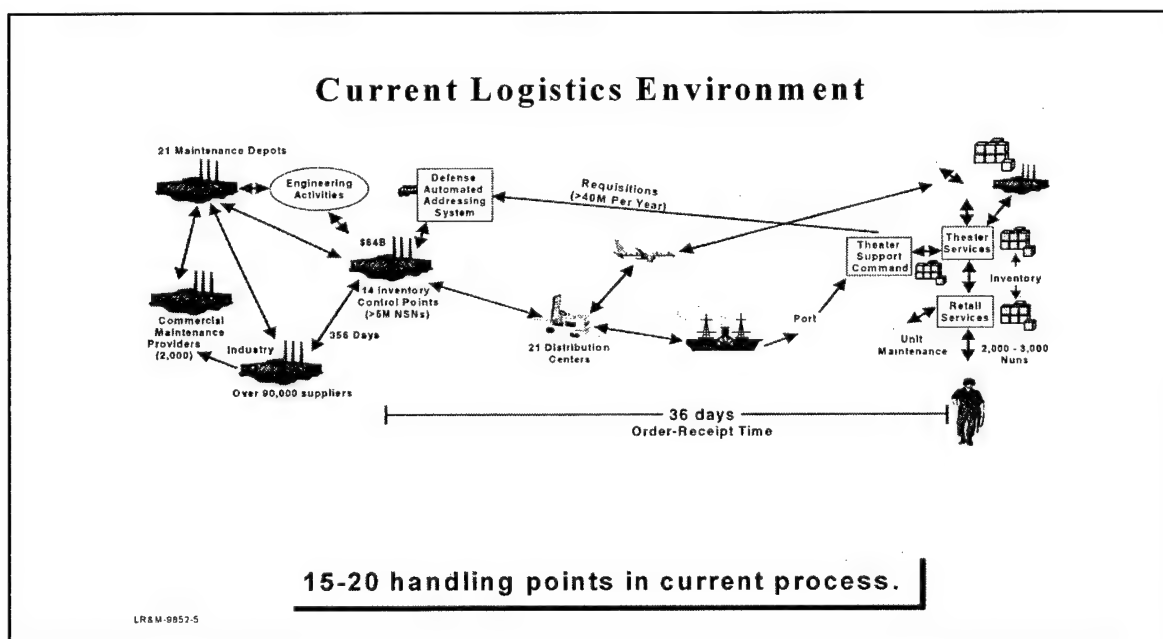
The increasing age of weapons systems further exacerbates the **growing O&S cost** and the **reduction of readiness levels**. Because of this situation a different formula for

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†† Team Charter at Appendix 2

applying these diminishing resources is needed and is being sought. The new formula, however, has to be compatible with and not adversely affect readiness. In fact, the current state of readiness of the services would necessitate a sustainment methodology that could indeed raise the level of readiness in spite of the reduced President's Budget.

Today's forces are some 45% smaller in mission forces personnel; yet these forces are still fulfilling worldwide tasking and deployments.<sup>§§</sup> In fact, from 1990 to 1998, we have almost tripled deployments over the total number of deployments in the prior 30 years. Mission readiness has indeed been degraded in the services. USAF F-15 wings have reported an inability to achieve fully mission capable standards. Navy units are deploying at degraded readiness levels.<sup>\*\*\*</sup> Support costs have been increasing because of the lack of resources to repair and modernize the aging systems, and these costs accelerate and further eat into the decreasing budget. The remedies to date have been the reduction in non-deployment operations, (e.g. one million-hour reduction in Air Force flying hours in answer to O&S costs exceeding 35% of budget).<sup>†††</sup> This sort of action-reaction has put the defense system in a spiral of degradation.



**Figure 3. Current Logistics Environment**

§§ JDMTP S/RWG Investment Strategy

\*\*\* Ibid

††† Ibid

Further exacerbating this situation of readiness is today's DoD logistics environment. Referring to Figure 3, in the logistics environment of today, the average lead time for items in stock is 36 days, brought about by the 14 inventory control points, 21 maintenance depots, and from 14 to 20 handling points from order to receipt. For items not in stock, the average cycle time balloons to 364 days. While resources for spares and maintenance have diminished considerably, the logistics pipeline has not been compacted to adapt. Nor has it become more agile to provide quicker response time or accommodate a lower total inventory of spares and components. In the 1990s Industry downsizing, however, the commercial sector did adapt by reducing the logistics cycle times and supported their enterprise more efficiently.

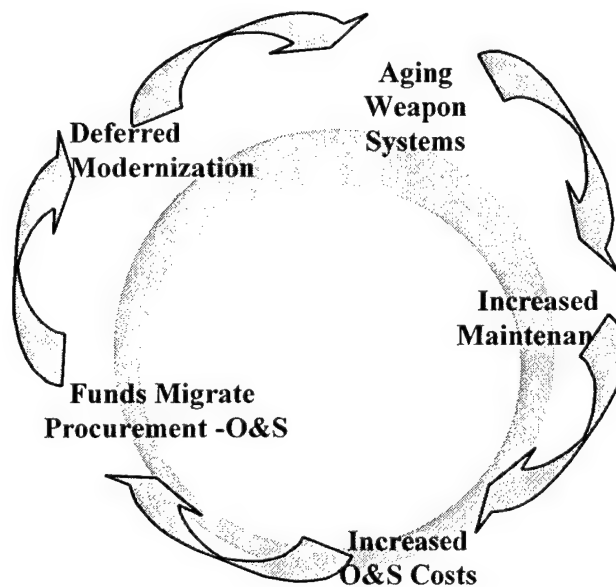
## The Vicious Cycle

The best explanation of the situation that the services find themselves in today has been explained in a not-so-tongue-in-cheek example termed the "Vicious Cycle."<sup>†††</sup> The notion is this; with lower-than-normal funds for modernization and upkeep, the aging fleet of "legacy" systems suffers accelerating deterioration. With lesser resources available to maintain the systems, the unabated deteriorating process actually generates the need for increased resources. Unavailable in the President's Budget, these resources are siphoned from other accounts, or deferred from being applied to the operations support accounts such as training, and testing. Resources for replacement systems are virtually non-existent because of the transfer of resources that occurred with the "peace dividend." Reflecting on the representation at Figure 4, **"The Vicious Cycle"** of *Deferred Modernization* leads to *Aging Weapon Systems* which require *Increased Maintenance* resulting in *Increased O&S Costs* which must be funded by *Funding Migration from Procurement to O&S*. This situation has been explained by various leaders in defense and in the private sector as the most dangerous situation degrading our readiness levels, primarily because there **appears to be no current method to break this cycle**. While goals and objectives have been directed that mandate the levels to be

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<sup>†††</sup> Logistics in the 21<sup>st</sup> Century

reached in order to make the funding equation work,<sup>§§§</sup> no specific implementation guidance to develop a sufficiently different, beneficial “**cycle for modernization**” has been given. This paper postulates an approach to resolving this dilemma. *It poses some risk to DoD as the timing of curtailment of low reliability components and their replacement or upgrade is coordinated, but the concept achieves the primary objective of: **Maximizing the Availability and Readiness of Weapon Systems for the Warfighter.***



**Figure 4. "The Vicious Cycle"**

Revolutionary thinking and revised procedures are necessary to break this vicious cycle. Piecemeal or patchwork solutions superficially correct the problem. It will be necessary to radically transform the traditional DoD support systems, allocate funding from the already tight DoD budget to recognize existing and forecast obsolescence in existing weapon systems, and begin a new cycle for their replacement or modernization. There are four major issues to be attacked simultaneously in order to correct the situation: **inventories, reliability, maintenance concepts, and funding**. Without a concerted, simultaneous attack on all four fronts, the probability of success is minimal. Once this revolutionary step is taken and breaking the traditional way is done, a more “Vital Cycle”

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<sup>§§§</sup> DSAC Goals



can be entered (Figure 5). This cycle is characterized by Consuming the Existing Lots of Low Reliability Parts and reliance of Two Levels of Maintenance rather than the traditional three. By relying on the private sector to step into the responsible role of supporting the forces, O&S costs can be decreased. Then resources can be freed up to migrate to the procurement accounts and reduce further the costs of maintenance and spares by using innovative methods such as “upgrade spares” which contribute again to the freeing up of resources to the procurement of modernized systems. The cycle begins with the issuance of direction to consume the existing levels of spares without replenishing them with equal low reliability spares.

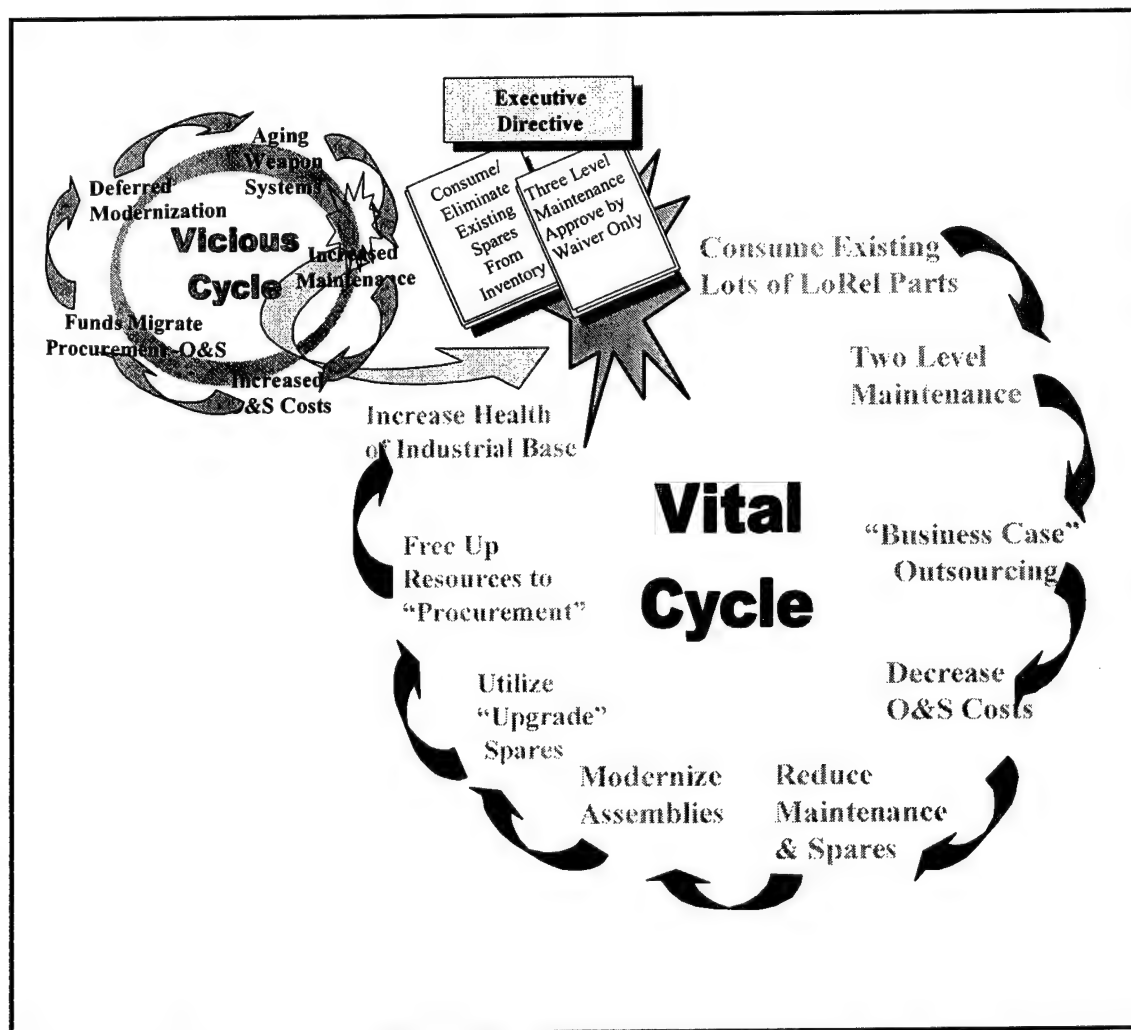


Figure 5. The Transition to a "Vital Cycle"

## Setting the Stage for Breaking the Cycle

The process below will create the opportunity space and funding necessary for DoD to break the current vicious cycle and develop a cycle more beneficial to supporting existing and emerging weapons systems and subsystems.

1. **Analysis:** Conduct an analysis of current O&S costs for each major weapon system within a service's inventory to establish Future Years Defense Program (FYDP) funding levels for the following: Unit/Operational Spares and Maintenance, Intermediate Level Spares and Maintenance, Depot Level Spares and Maintenance. Total Ownership Costs must include all categories of O&S exclusive of those associated with the mission crew, Petroleum-Oil-Lubricants (POL), and consumables. It is imperative that all infrastructure costs be associated with these categories, something that DoD has consistently underestimated in the past.
2. **Categorize: Prioritize** the major weapon systems to determine which subsystems are candidates for modernization. Prioritization includes threat assessment and economic benefit analysis, e.g. mean time between failure (MTBF), decrease O&S support costs. Metrics for this process would include MTBF, cost, technology level, fielded units, present readiness level, improved response to threat, and system importance.
3. **Target:** Based upon the Total Ownership Costs determined from the analysis performed in step 1, establish a target cost reduction and improved system availability goal for each of the subsystems. This could be benchmarked against current commercial technologies.
4. **Implement:** Issue multiyear (5-year minimum) solicitations. Compete the Total Ownership of the systems and subsystems, requiring guaranteed MTBF improvements and a warrantee. Open competition to government depots and the private sector. The company winner of the competition takes title and configuration control of the system and all existing spares. That company is then required to meet

system availability targets or pays penalties until the improved availability is met. Contracts require only FFFI compliance, as well as involving the customer in major design decisions. Use Other Transaction Authority or COSSI program initiatives to reduce contract cycle time.

5. **Reinvest:** Savings accruing from this formula can be applied to replacing, modifying, or upgrading obsolete weapon systems or to the acquisition accounts to procure new systems. Formula sharing of the savings can take many forms to solve defense wide problems. For example, sharing the savings by application to a DoD wide pool of resources (e.g. 60% to the operating service and 40% to the DoD pool).

## The Process

This concept can only be achieved by using a drastic starting action. That drastic action is a DoD executive directive, similar to the order that curtailed the use of MILSPECs, that curtails further procurement of low reliability spare components and parts and the funding of maintenance activity beyond the organizational level for high failure rate (i.e. high support cost) systems and subassemblies (Identified through the “analyze” explained above). Exceptions to this directive should only be made on a case justified basis in order to force the momentum to change from “sustainment” to “force modernization.” Based upon existing Total Ownership Cost Models approximately twenty percent (20%) of current O&S costs for these systems could be made available for reallocation to modernization.

The next step in the process is to perform a Total Ownership System Solicitation (TOSS) which competes the responsibility for total ownership and configuration control of the systems and subsystems starting with the top of the priority list found in “Categorize” above. The following step in the process is to transfer the responsibility and Total Ownership Cost of the sub-system to the private sector. The winning company is now responsible for providing the system the DoD. No restrictions on cost savings are imposed, except for performance and readiness level requirements. That is to say, the company is now operating the system in a complete profit/loss mode, as would a private

sector company. If the company reduces costs of operation through innovative means, the rewards of increased margins accrue to the company. If the company reduces the cost of maintenance through increased MTBF, increased reliability of the system, through upgrade sparing, modification, redesign, or component replacement with advanced technology, the company benefits the increased margins, and is allowed to reinvest, change configuration, change anything except form-fit-function interface with other systems. The Government benefit is reduced cost of operations and support, increased utility of the system, reduced cost of intermediate maintenance infrastructure, and most importantly, the ability to divert resources to other accounts (acquisition, operations, etc). Resources freed at this point in the new cycle can also be applied to the systems/subsystems not economically viable for private sector investing. Eventually, through an iterative process, higher risk, lower reliability systems will re-enter the analysis cycle to determine the persistence of the high cost situation and to form the basis for determining possible greater levels of incentive for the next round of solicitation.

The above process is only one dimension of the solution, the remaining solution areas deal with outsourcing logistical processes to the commercial sector which have demonstrated excellence in global sustainment. The present sustainment situation is not unique to DoD and is in fact a situation similar to that faced by Industry with regard to reducing operating costs. Industry has taken the approach of defining core competencies relative to the markets served and then outsourced or formed strategic alliances with other companies for those activities which are not a core competency. The field of logistics has long been considered a core competency by DoD, particularly when there were no other alternatives to providing this capability to the warfighter. However, building and maintaining this logistics capability is prohibitively expensive. Today we live in a global economy and logistical support is a reality for all companies who do business on a global scale. Many of today's global companies have developed significant capabilities to support their products or services and since they have this core competency they are often willing to sell their knowledge base and infrastructure on a transactional basis to other industries and even competitors.

## **Actual Alternative Support Concepts**

### **ARC-210**

The ARC-210 radio is a case study that illustrates the principles of this "Vital Cycle." The Navy achieved both a cost of ownership reduction and a significant improvement in mission availability for the warfighter through an innovative Reliability Improvement Warranty program. Key to achieving these improvements was the retention of configuration management, the depot and intermediate level spares ownership and depot support capability by the contractor (Rockwell Collins) and their commitment to improved reliability and availability of the radio in the field. When the support contractor has the ability to make changes to improve system performance while maintaining form, fit, function and interface conformity both the military and the contractor win. Modernization occurs, spares and inventory decrease, availability for the warfighter improves and costs go down. However, failure to include any part of this recipe in the solution will have an adverse impact on field availability and will negate the desired affect of improved modernization and decreased cost of ownership.

### **Caterpillar-Allied Alliance**

Another example of a private sector alternative support contract is the Allied Signal - Caterpillar alliance. This idea couples the strengths of two global industries which service very different markets but effectively support customers in each. The Allied Signal - Caterpillar alliance is based upon Caterpillar's core competency to achieve a 99.99% on time shipment of parts and material to ensure availability rates of 99.8% for fielded equipment. It provides airlines with the ability to reduce inventory and personnel costs while simultaneously achieving the required availability. The program is based on eight key customer expectations:

- **Reduce material costs and overall cost of ownership**
- **Maximize supply availability for the customer**
- **Minimize repair turn around times**
- **Minimize inventory**

- **Incorporate state-of-the-art technology**
- **Provide innovative contracting**
- **Maximize high quality performance**

**Table A-1 – CAT Clients and Service Portfolio\***

	<b>Contract Inventory Mgmt</b>	<b>Trans- port</b>	<b>Ware- housing</b>	<b>Systems</b>	
Fortune 50 Aerospace Co.	1997	X	X	X	X
Fortune 500 Tool Company	1994	X	X	X	X
U.S. Automotive Manufacturer	1990	X	X	X	X
Midwest Regional Telecom Co.	1990-98		X		
Automotive Parts Company	1997	X	X		
Major Ind Component Manuf	1991		X		
Top 5 Footware Manuf	1989-97		X		
Int'l Auto Component Manuf	1998	X	X	X	X
U.S. Int'l Computer Hdw Manuf	1997	X	X		
Mid East Ind Parts Manuf	1995	X	X		
European Ind & Motorcycles	1996	X	X	X	
Major Ind & Auto Manuf	1996	X	X	X	X
European Auto Manuf	1996	X			
U.S. Specialty Metals Company	1989		X		
UK - N. America Auto Manuf	1987-97	X	X		
UK Parts Distrib & Manuf	1986	X	X		
UK Int'l Ind Components Manuf	1997	X	X	X	
Int'l Ind Machinery Manuf	1992		X		
Japanese/U.S. Ind Mach Manuf	1993	X	X	X	X
U.S. Int'l Transportation Co.	1987	X	X		
European Ind Components Manuf	1993	X	X	X	X
U.S. Int'l Indust. Components Mfr	1992		X		
Major European Automotive Mfr	1996	X	X		
U.S. Industrial Components Mfr	1994	X			
UK Automotive & Indust. Mfr	1991		X		
European/U.S. Automotive Mfr	1992	X	X	X	X
Top 3 Indust. & Electronics Mfr	1994	X	X		
U.S. Int'l Computer Systems Mfr	1992	X	X	X	

\* Under the terms of the service contract, each one of the above clients must individually approve each

occasion when his/her contract with CAT Logistics is explicitly outlined.

To support these activities CAT developed a cost competitive logistics information system which focused on customer service while minimizing inventory investment and maximizing personnel productivity. This system is currently operating at user sites on three continents and providing full, real-time visibility of material status. This on-line system has been linked with client information systems, providing seamless functionality with existing maintenance, warehousing, forecasting, planning, purchasing, and material tracking capability. A representative list of companies using the system is at Table A-1.

**Table A-2 -- Benchmarking Study**

<u>Category</u>	<u>CAT Logistics</u>	<u>DoD</u>	<u>Typical ICP/Depot</u>
Scale of Operations (hr/day/wk)	24 /7	24 /7	8 /5
Distribution Centers	38	17	1
Part No's Managed	>3 million	>7 million	26,875
Ship Vol/Line Items/Day	123,400	82,000	2,600
Distr. Center Sq Ft	>5 million	unknown	814,000
On-Hand Inventory Value	negligible	\$68 billion	\$50-\$112 million
Receipts Vol/Line Items/Day	28,200	Data not tracked	474
<b>Performance - Orders</b>			
On-Hand Shipment Performance	99.9%	Data not tracked	Data not tracked
Order Lead-time			
(Days On-Hand Items)	2	49	8.5
Receipts Processed Same			
Day Inventory Received	99.9%	Data not tracked	Data not tracked
<b>Performance - Inventory Management</b>			
Inventory Turns/Year (Avg)	4.73	0.71	Data not tracked
Stock Availability - Avg Fill Rate	96%	Reported @ no better than 85%	18-39%
Items Filled (On-Site Inventory in <11 Days)	--	<20%	55-62%
Cycle Count Accuracy	99.2%	Not tracked	Not tracked
<b>Performance - Personnel</b>			
Distr. Center Personnel			
(Receive, Store, Pack)	>2,000	>69,000	>375
<b>Performance - Automated Information Systems</b>			
Number of Logistics Systems	1	586	>10
System Availability	99.8%	Not tracked	Not tracked

The Caterpillar-Allied Alliance then performed a benchmarking of the effectiveness of the DoD product support operation relative to those for nine industrial organizations of various sizes involved in the distribution and product support in a number of different markets such as automotive, computers, communications, electronics, transportation, commercial aircraft and off-road equipment. The analysis of the customer defined drivers revealed six areas of greatest negative impact on efficiency, cycle time and inventory for DoD Inventory Control Point (ICP)/Depot product support operations. These were:

- Multiple Stand-Alone Data Systems: 126 incidences

- Non-Linear Workloading (Large Percentage of Slack-Time and Unnecessary Overtime During Work Cycle): 96 incidences
- Invisible Assets (Assets Not Accounted for in the Database): 84 incidences
- Late Deliveries and Variability of Requirements: 78 incidences
- Decentralized, but Competing Similar Functions: 68 incidences
- Inadequate/Unsatisfactory Supplier Performance: 54 incidences

The results of the benchmarking study are summarized in Table A-2 (above).

Commercial logistic support methodologies similar to those benchmarked above are available to improve O&S operations. Improvements made to five representative commercial companies are shown in the performance grades in Table A-3 (below).

<b>Table A-3 -- CAT Logistics Commercial Performance</b>				
	<b>Fill Rate</b>		<b>Inventory Turnover</b>	
	<b><u>Before</u></b>	<b><u>After</u></b>	<b><u>Before</u></b>	<b><u>After</u></b>
<b>Client A (Automotive)</b>	<b>94%</b>	<b>98%</b>	<b>5.8</b>	<b>6.8</b>
<b>Client B (Automotive)</b>	<b>70%</b>	<b>92%</b>	<b>1.9</b>	<b>3.7</b>
<b>Client C (Industrial)</b>	<b>65%</b>	<b>95%</b>	<b>2.5</b>	<b>4.0</b>
<b>Client D (Mat'ls Handling)</b>	<b>89%</b>	<b>94%</b>	<b>0.7</b>	<b>1.7</b>
<b>Client E (Mat'ls Handling)</b>	<b>89%</b>	<b>93%</b>	<b>0.9</b>	<b>1.5</b>
<b>Client F (Retail Goods)</b>	<b>73%</b>	<b>91%</b>	<b>7.2</b>	<b>10.7</b>

## **Power-by-the-Hour**

Another method currently being used by the Commercial Airline Industry is Power-by-the Hour. Under this program, the OEM's repair facility accepts responsibility for the day-to-day reliability of the equipment that it designed and manufactured. Airlines depend upon 100% availability of their aircraft in order to maintain schedules and earn revenue. When a multi-million dollar asset is not available due to a component or subsystem failure, the airline is losing not only revenue from the flights which are not being flown, but there is an intangible long term impact due to adverse impacts to the customers expecting to be served by those flights. The dilemma for the airlines is to



determine what level of support they can afford at each airport or hub. The airline is responsible for proper maintenance of the aircraft, including the accomplishment of recommended maintenance actions stemming from the reliability analysis program to form a true lessons-learned database. This procedure forms the closed-loop relationship between line and shop maintenance, providing more efficient repair of aircraft systems and components. The business basis for this type of partnership is a *flight-hour maintenance agreement*. Typically, this type of program covers the test and repair of equipment for a fixed price per aircraft flight hour. Participating carriers have seen significant maintenance cost reductions and reliability improvements. The program is most effective when the OEM is responsible for maintaining all like units in order to develop statistically valid reliability reporting and analysis systems. It represents a win-win partnership between the airline operator and the OEM.

To illustrate how effective such a program can be, Rockwell Collins has initiated component maintenance agreements with major airlines which provide proactive maintenance based on tracking equipment performance, inputting the information to design changes and maintenance inventories. The result over 18 months for one carrier's equipment, such as electronic flight instrument systems, including the cathode ray tube displays and processors, exhibited improvements in performance of 26% to 133% in mean time between unit replacement (MTBUR) and mean time between failures (MTBF). Standard radio equipment showed improvements ranging from 11% to 123%. None of the equipment supported demonstrated a decline in overall performance. During the same period, the resulting reductions in flight-hour costs ranged from 12.6% to 20%. The new reliability performance data have enabled one carrier to reduce its spare requirements for newly delivered aircraft by several million dollars of spare components and significantly reducing administrative time related to component maintenance.

## **Culture Change for DoD**

So what does this mean to DoD? Worldwide logistics support is available today from multiple sources within both the Defense and Commercial Industry. This support can be procured on a competitive basis based upon the availability required for various weapon

systems. There is very little difference in servicing an F-16 and a Boeing 767 from a logistics support perspective. However, there is a lot of difference between loading munitions and loading passengers. The key point here is understanding the core competencies within the DoD and Industry. DoD has developed the core competency of developing, transporting, arming, and delivering ordnance. There is very little need for this competency in the commercial world. DoD has not developed the core competency of lean (minimum cost) logistics for service and support and should use Industry for this purpose.

To complete the paradigm shift, making the **Vital Cycle** an effective means of modernization, the DoD must also move to an organizational structure which places control of and responsibility for Total Ownership Costs for the weapon system on the government system program manager. Additional cultural changes must also be sought. The laws that tightly control the resource accounts ("color of money") will have to be amended to permit the government system program manager to reprogram funding as necessary in order to accomplish effective modernization. While change is ultimately in the control of the Congress, the change in accounting and resource control will have to be initiated by the DoD. Control mechanisms should change to measure the effectiveness of investment made by the team to improve the availability and readiness of the managed weapon system to the warfighter. Use of mechanisms such as Force Readiness Status Reports should provide data on the effectiveness of the responsible program management team.

The lag time for improvements to materialize relative to the modernization of fielded weapon systems require time periods that exceed normal government personnel rotational periods (nominally longer than 3 years). System Program Management leadership will have to be in place for longer periods of time, and this will be a major cultural change. A commitment of this level for a uniformed member of the DoD has major career implications, which need to be recognized. Adequate career advancement opportunities must be made commensurate with these sacrifices.

The politics associated with the military depots must also be dealt with and eliminated if the **Vital Cycle** is to succeed. Where military depots have critical core competencies

relative to specific weapons systems, they must be capable of partnering with Industry or subcontracting to Industry at competitive prices. These depots cannot be protected “at any cost” using political manipulations, that action would negate any gains and thwart the competitive nature of cost reduction actions. With few exceptions modernization of weapon systems is not a competency of the existing military depot system as they have been established to return worn, damaged or failed hardware to the officially recognized configuration regardless of existing or forecast obsolescence. Therefore, military depots should be incentivized to move work into the industrial sector when it is cost effective based upon the executive mandate to modernize the supported weapon system.

### A Focus on The Specifics, “The Process & The Filters”

The mechanisms by which these processes proceed are graphically depicted below in Figure 6.

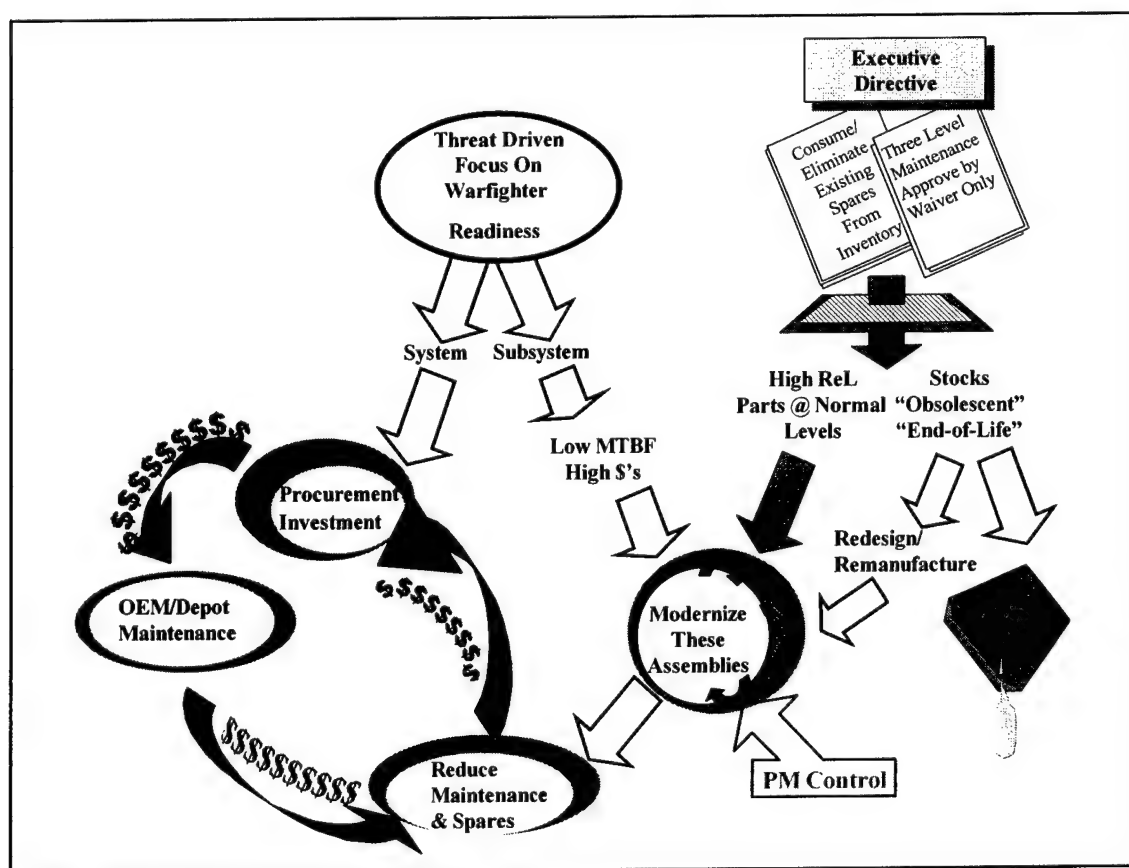
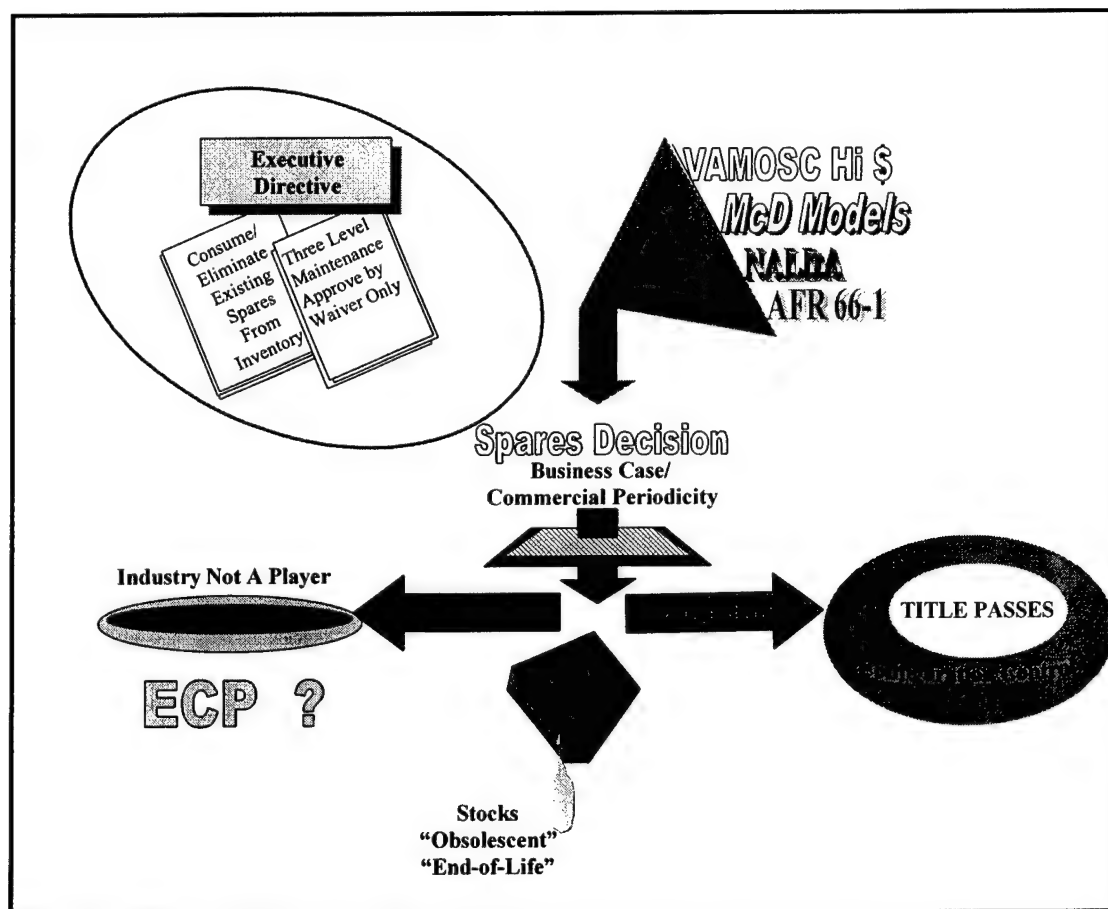


Figure 6. The Mechanisms within the Vital Cycle

Starting at the top right hand corner of Figure 6, a direction from the Secretary of Defense is needed to stop traditional activity and start the revolutionary approach. The proposed directive specifically prohibits intermediate maintenance except by waiver. The second directive orders consumption of all existing low reliability spares after examination for entry into the new commercial arrangements. After the directive to suspend intermediate maintenance and use up existing spares is made, the criteria for pursuing the alternative system is applied to identify low reliability parts, subsystems that are costly to support, items that have reached end-of-life or obsolete, or fall into the margin of diminished manufacturing sources. Much like the Direct Vendor Delivery (DVD) concept, the decision is made based on a filtering process to compete the system for long term support by commercial means.

Direct Vendor Delivery is a procurement technique initiated by the Defense Logistics Agency (DLA). Its purpose was to provide a vehicle to deliver large volume commodities directly to the user. The first instance of this method was the direct delivery of pharmaceuticals from a commercial distributor to the hospital. A similar process was used with commissaries. A variant of the DVD method is the Direct Vendor Delivery – Repairables (DVD-R) which is also referred to as DVD-Plus (DVD+) a joint effort on the part of NAVICP and the Aerospace Industries Association (AIA). The purpose of DVD-R is to reduce the Government's overall cost to provide weapon system logistics support, improve availability and reliability, and to streamline the procurement/administrative process. The differences in this idea and the DVD process is this: the decision must be made solely on cost and reliability from the government view and from return on investment and margin analysis from the Industry viewpoint. If the item is entering the "obsolete" realm, then the pathway leads to use of all end items. There will be some cases where redesign or remanufacture is the only method available to provide the system/part/component to the weapon that will sustain the forces. In this case no cost advantage is gained for the immediate situation. The general notion however is to use up the high-cost, low-reliability parts and then enter into a stream of modernization by spares.

An example of a current DVD program is one that provides Auxiliary Power Equipment to the Navy. This program is a support program which allows the Navy an efficient use of resources. The concept has been recognized by Congress and appears to be a good way of combining skills from Government and Private sectors. This particular effort focuses on the APU equipment for U.S. Navy aircraft: P-3, S-3, C-2, and F/A-18. DVD is a new idea for both the Navy and the company. However, this is a better way to support APU repair, it could also be a model for future direct Industry to Military logistical support.



**Figure 7. The Decision Process: A Business-case Filter**

A central decision process of the mechanism is shown in Figure 7, and represents a filter based upon a business case. This decision process includes a review of the low reliability parts and obsolescent subsystems by the private sector company to ascertain the attractiveness of the business. This could be the result of open competition or direct

solicitation if the component is provided by only one company, but the decision process then rests with the company. If there is sufficient ROI for the private sector company, the company will have incentive to seek ownership and control of the T.O.C. of the item. A business plan is presented to the Government. Then the transition of ownership of the system should be contemplated and solicited by the government. Award of the total ownership (including the configuration control and the risks of profit and loss) is then made on a long-term (five to ten years) basis to the successful bidder. The outcome of this situation is important to understand. The company spends resources to improve the performance of the system, thereby reducing the need for further costly attention (whether it is maintenance, repair, overhaul, upgrade, etc). The price to the Government lowers (because the new efficiencies of the system can afford it). If the business is not attractive, the company in the private sector will more than likely pass. That leaves the item in a situation of more or less the status quo. That is to say, the same infrastructure will be needed to effect the repair or provide service. This service could be supplied at the Government depot, or by a defense company under contract to provide traditional cost plus type efforts for the DoD. However, once the revolutionary activity stream is proceeding and growing, the resources freed up by the commercial activity can be applied to the procurement accounts and the modernization accounts either for new systems or reinvestment in legacy system improvements. This, of course, can only happen if there is freedom of movement of resources that have been hindered by the "color-of-money" barrier.

## Summary

The Industry Sustainment Team has identified some bold actions to be considered by DoD in a serious attempt at affordable sustainment, and the climate for these bold actions is favorable. The utilization of the “**Vital Cycle Process**” is a major step to provide a **significant reduction of sustainment costs** of legacy systems and additional funds for new procurement. A significant reduction in the growing defense sustainment costs requires a **drastic starting action**, a **business-case filtering mechanism** for continuous product improvement with Industry partnering, and the adoption of **commercial logistics concepts**. This proposed mechanism coupled with an executive directive will:

- Change the concept of maintenance from three levels to two levels, except by waiver.
- Deplete low reliability spares and insert higher reliability, lower cost spares resulting from Industry/Government partnering.
- Use the Total Cost of Ownership concept within a business-case decision filter.
- Require a change in System Program management tenure and some changes to the “Color of Money” practices.
- Use Best Commercial Practices to identify further methods for sustainment cost reduction through improvement to infrastructure, lower inventory, better logistics turn-around time, and large reductions in acquisition cycle time.

In addition to the above, increased exchange of requirements information between the Services and Industry is recommended to enable the use of current effective technology. Industry is supportive of the idea to make the Department of Defense “operate like a business,” but without revolutionary change to the DoD sustainment systems and culture, the objectives sought by the Department will be more difficult to achieve. For example, DSAC goals seek shortening the cycle time of acquisition by fifty percent. Considering the nominal twenty-year cycle that is prevalent in defense acquisition, ten years is certainly an improvement. Greater acquisition cycle time reductions are possible. The NCAT Evolutionary Defense Acquisition model demonstrates how major system development can be accomplished in 5 years, including fielding and user operation evaluation of battle group size production prototype lots. Development of non-major

items can be done in 3 years, including fielding of low-rate productions for similar operational and continuing warfighter use. Pursuing programs using the Evolutionary Defense Acquisition (EDA) model, currently resident in the DoD acquisition desk book, can reduce the acquisition cycle substantially. The ideas of the EDA, similar to those of the vital cycle, come from the inventiveness of the private sector. "Re-engineering the logistics system" part of DSAC Goal #1 requires another departure from traditional DoD logistic functions. The Sustainment Team suggests that rather than piecemeal reengineering of the DoD logistics infrastructure, a quicker way of achieving the goal of a world class distribution operation would probably be to outsource to one or a number of existing commercial "off-the-shelf" operations. The DSAC goal of reducing the logistics response time by 50%, including reducing the repair cycle, can be met by doing this. Goals "two" and "three" of the DSAC "Into the 21<sup>st</sup> Century" paper are closely linked to the concept of a new cycle in this paper. Actually, the resources shift from O&S to modernization relies on the linkage of these two goals.

Lowering total ownership cost and allowing funds to shift to modernizing from infrastructure can only be accomplished if non-traditional provisions to allow the migration are made. Traditionally, "cost savings" and "cost avoidances" do not "flow" back to the individual program nor to the major force program account, but are captured by the general account or go back to the U.S. Treasury. This barrier has been the major stumbling block in past innovations which failed to materialize because of the reluctance to modify the inflexible system of accounting for the Department's budgeting and execution process.

Passing title of legacy systems and/or their components to original equipment manufacturers should be considered as a method to allow the "freeing up" of resources from infrastructure and support. These arrangements can significantly reduce O&S infrastructure costs, freeing up resources to fund modernization and new acquisition. This is by far the most significant revolutionary idea that requires complete paradigm change. By passing ownership to a company and contracting for service-based requirements fulfillment arrangement, the resources traditionally programmed for logistics can be shifted to fund modernization issues.



Adopting and executing commercial business practices is an outstanding objective, but will require major efforts of partnership and trust with Industry and Government the key participants. We suggest continued participation of Industry teams in the formulation of these goals and executing plans.

## APPENDIX 1

### SUSTAINMENT TEAM CHARTER

#### **Objective**

Focus on the S in the O&S costs. Assist in the identification of resources needed to improve sustainment technologies and attempt to identify these sustainment technologies as they apply to procurement of new systems.

#### **Charter**

Conduct a thorough study of weapons systems sustainment. Highlight barriers, cost drivers, and issues confronting Industry in their attempts to reduce sustainment costs. Provide methods for reducing the growing cost and effort of Sustainability by identifying high cost drivers of major weapons systems, determine what portion of those costs could be reduced effectively and identify the barriers or innovative solutions for reducing or eliminating the high cost area. Take the results of the analysis to the attention of the decision-makers in the Department of Defense in the form of plans or recommendations.

#### **Possible process to gather needed information**

1. Focus on a single weapons system (e.g. F-16.)
2. Breakout the O&S costs for the system into categories such as: POL, Ammunition, Consumables, Maintenance (Concept plus organic vs. contractor depot), Spares, Personnel, Logistics footprint (mobility), Avionics DMS, Support Equipment, Joint Vision 2010, etc.
3. Achieve an understanding of the systemic causes of the costs.
4. Achieve an understanding of the costs associated with recruiting, training and sustainment of personnel by category: avionics, engines, airframes, weapons etc.
5. Brainstorm a variety of alternative approaches to find existing models, which have tackled these problems to determine what if any cost savings could result.

## APPENDIX 2

### Sustainment Team Membership

Pertowski, Ted, Chair	GEC Marconi
Berecz, Karen	Raytheon
Birchfield, Burt	The Boeing Company
DeCaire, John	National Center for Manufacturing Sciences
Fernandez, Charlie	Lockheed Martin (Dallas)
Friedericy, Hans	Allied Signal
Francis, Emmett	GEC-Marconi H
Gordon, Mark	NCAT
Lindsey, Paul	Marconi Aerospace
McCarty, Frank	Society of Manufacturing Engineers
McClendon, Eddie	Raytheon
Michel, Fred	Society of Manufacturing Engineers
Schaaf, Cliff	Lockheed Martin
Schwach, Clifton	Rockwell Collins
Shaw, Tom	Anderson
Siegel, Stan	NCAT
Syslo, Joe	NCAT

## APPENDIX 3

### AN/ARC-210 Cost/Benefit Analysis

The following costs and benefits have been realized by the ARC-210 program since the incorporation of the Reliability Incentivized Warranty (RIW) program.

#### **Government:**

<u><b>Cost:</b></u>	<u><b>Benefits:</b></u>
<ul style="list-style-type: none"><li>• Establish Contractor Depot/RIW Support</li></ul>	<ul style="list-style-type: none"><li>• Reduced Acquisition Cost</li><li>• Timely Incorporation of Latest Technology</li><li>• Elimination of Organic Depot (and associated costs)</li><li>• Improved Reliability (MTBF)</li><li>• Reduced Number of Spares in the Logistics Pipeline</li><li>• Personal Pride in Being Part of a Paradigm Busting Program</li></ul>

#### **Contractor:**

<u><b>Cost:</b></u>	<u><b>Benefits:</b></u>
<ul style="list-style-type: none"><li>• Contractor Funds All Non-Recurring Effort</li><li>• Contractor Funds Cost To Upgrade Hardware</li></ul>	<ul style="list-style-type: none"><li>• Reduced Cost To Manufacture</li><li>• Increased Market Share</li><li>• Timely Incorporation of Latest Technology</li><li>• Longer Product Life Cycle</li><li>• Contractor Depot</li><li>• Contractor Receives Timely and Accurate Feedback on Field Problems (Failures - as evidenced by units returned for repair)</li><li>• Personal Pride In Being Part of a Paradigm Busting Program</li></ul>

## APPENDIX 4

The initial process decided on by the Sustainment Team to gather needed information was simple in concept. It was agreed that initially the team would:

1. Focus on a single weapons system (e.g. F-16.)
2. Breakout the O&S costs for the system into categories such as: POL, Ammunition, Consumables, Maintenance (Concept plus organic vs. contractor depot), Spares, Personnel, Logistics footprint (mobility), Avionics DMS, Support Equipment, Joint Vision 2010, etc.
3. Achieve an understanding of the systemic causes of the costs.
4. Achieve an understanding of the costs associated with recruiting, training and sustainment of personnel by category: avionics, engines, airframes, weapons etc.
5. Brainstorm a variety of alternative approaches to find existing models, which have tackled these problems to determine what if any cost savings could result.

**The team did not deviate much from the basic plan and agenda, but discarded the notion to zero in on one weapon system early in the discussions. There were other side discussions. For the most part the team remained focused on the task at hand, that is, to identify methods that would revolutionize the manner by which DoD sustainment proceeds.**

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## **Appendix L**

### **“Spin-On” Technologies for Affordability**



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# **“SPIN–ON” TECHNOLOGY FROM NON- TRADITIONAL SOURCES**

**Proceedings of the DUAP Workshops**

**October 1997**

**March 1998**

**Report Number 98-M1A**

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April, 1998*

**PREFACE**

This document was prepared by the National Center for Advanced Technologies (NCAT) for the Office of the Director, Defense Research and Engineering, under a task titled, "Dual Use Applications Office Support" contained in a grant "Planning of Manufacturing Technology Activities with Industry," and pertains to the objectives of the task to continue support for facilitating "Spin-On" work shops, which engage non-traditional DoD Industry participants providing private sector recommendations.

The following NCAT staff members were reviewers of this document: Mr. Mark Gordon, and Dr. Robert Post

Author and editor: Mr. Joe Syslo, VP NCAT

## Introduction

During the latter part of the summer of 1997, The National Center for Advanced Technologies (NCAT) sponsored a series of "one-on-one" interviews/conversations between Industry and Government executives to identify some parameters for discussion into issues revolving around "spinning on" commercial technologies into defense systems. Commercial technologies are being pursued because it is perceived that technological solutions to problems reach the marketplace faster in the private sector than do products in defense. More resources are spent by the private sector for R&D than in defense, and the ability to leverage this source of technology is seen as being potentially beneficial to the defense requirement.

Distilling the "one-on-one" interviews provided an increased clarity into what one could reasonably expect when delving further into the idea of accessing technology from non-traditional commercial sources. The material gained from the summer sessions was used as a basis for further information gathering in a planned series of roundtable workshops.

The first workshop, hosted by NCAT, was attended by senior Government and Industry managers. This workshop had a "prime-centric" view; that is, the Industry component of the workshop team represented large companies generally referred to as "prime contractors." Follow on workshops were planned to include mid size companies, small businesses, process companies and materials suppliers, so that the entire "food chain" could be observed.

The second "Spin-On" workshop was also held at the National Center for Advanced Technologies (NCAT) in March of 1998. The focus for this information-gathering event was on the companies that generally supported another company in the pursuit of a product to market by providing material, manufacturing, or management technology. This workshop, continuing the conversations between Industry and Government executives to identify issues revolving around "spinning on" commercial technologies into defense systems, was considered the "tiered view."

This report combines the workshops. We now have a “prime-centric” and a “tier” view. The general idea was to achieve the best perspective by examining as much of the manufacturing “food chain” that could be observed. These proceedings are not meant to be a word-for-word account of the deliberations, but attempt to capture the “essence” of the workshop. Illustrations provided throughout the text were created during the workshop. The situational catalogue and “issues matrices” are exact reflections of the workshop.

## **“Prime Centric” View**

The beginning premise of the first workshop was: Government defense agencies may not have current information as to the status and location of leading edge technologies in the private sector -- technologies that are principally developed and marketed for purely commercial reasons. A follow-on premise to this was: these commercial technologies could benefit defense systems in terms of affordability. Driven by the need to maintain the leading edge of technology, (i.e. to equip US warfighters with the best, but most affordable, solutions to countering a threat) the preliminary vision of the workshop was stated as:

“There is a need to have full visibility of and access to commercial technology insertion prospects. The Defense Industry and its Government customer require the ability to evaluate the utility of such technology and, act on prospects that might enhance affordability.”

The premises were then distilled to a set of “strawman” issues to generate ideas for discussion during the workshop. These took the form of “hypothesized barriers” that could impede the process of incorporating commercial technology into defense systems. The barriers were based on the notion that non-traditional suppliers, that is, suppliers that did not normally operate as providers to defense “prime” contractors, had no incentive to market their product to the military. Additionally, it was thought that non-traditional technology providers saw the DoD, with its web of directives, regulations, acronyms and chilling oversight, as a hostile environment and a poor customer with which to do business. Compared to the private sector, defense system needs (in terms of large volume purchases for product) were far less than commercial product needs. It was also assumed from the early discussions that a non-traditional company had great difficulty in identifying the appropriate channels in which to conduct business. On the other hand, traditional defense “prime” companies had no incentive to seek out new channels of supply, or new companies to provide resources for integration. Many of the defense companies have long-term established relationships with suppliers. Recent mergers,

vertical integration and strategic partnering of the aerospace defense sector have solidified these relationships. Legacies of building core competencies in cost based pricing had further reinforced the barriers. Prior to entering the discussions, it was thought that the scope of the non-traditional supplier base was poorly understood, if known at all. Adding to this preliminary set of barriers was the burdensome technical screening process used by the DoD to review technical issues.

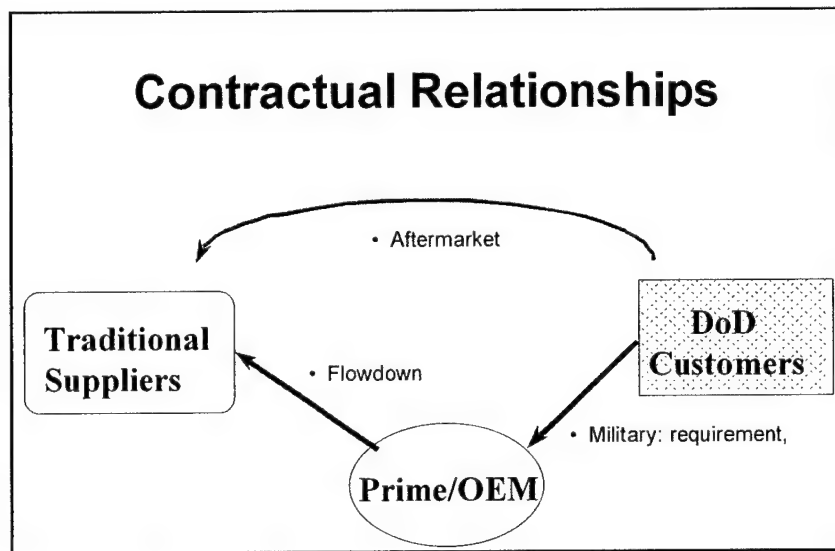
Distillation of these ideas led to the notion that any activity that would bring these barriers down or ease the connectivity of private sector technology to the DoD system, would have to be part of an “outreach” program. This outreach program would enable DoD needs to be made better known to Industry, particularly to the non-traditional private sector. It was initially thought that there would have to be a change in behavior on the part of DoD. At minimum, it was thought that the technical dialogue and exchange of information would have to be encouraged between the defense Industry and non-traditional sources. It was also thought that perhaps the prime contractor would have to be the principal “visibility improver.” However, if the problem existed today because of current mechanisms in place, then perhaps some other form of facilitator, a Government “technology scout” or external “technical bounty hunter” might be the formula for success. It was thought that the Government “technology scout” might require some sort of Government technology transfer infrastructure such as the existing Military Critical Technologies List (MCTL) or perhaps an entirely new infrastructure would have to be created.

With these notional ideas in hand, a “read ahead” packet was distributed to the workshop participants. (Appendix 1) The workshop attendees were identified (Appendix 2) and the workshop was held on October 7<sup>th</sup> 1997 in Washington D.C.

The workshop’s objectives were simply stated as:

- Attempt to reach a shared vision of the issues.
- Attempt to reach as complete an understanding of the hindrances that exist today.

Once these objectives were accomplished, the next step of the workshop would be to identify and perhaps prioritize some concepts for improving visibility and access into the notion of using commercial technologies in weapons systems. If this could be readily done, then some pilot programs to demonstrate these concepts could be advanced.



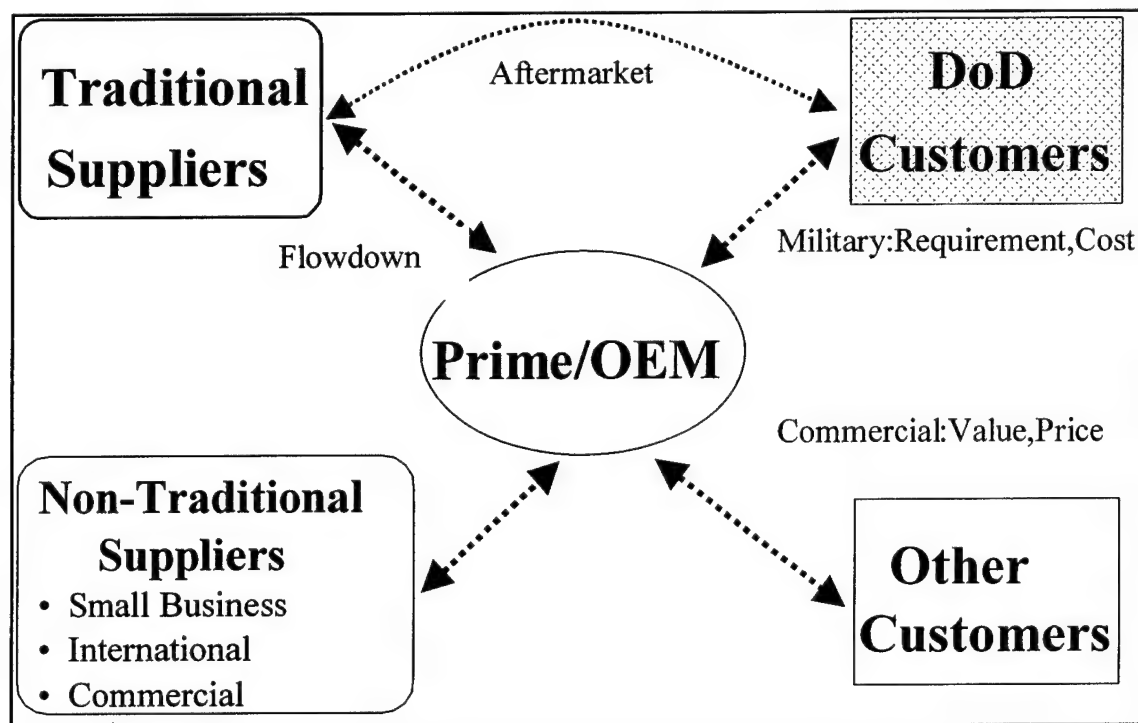
*Figure 1. Prime Contractor Relationships with Customer and Suppliers*

We have characterized these proceedings as a "prime-centric" view. Although there were non-traditional suppliers involved in these discussions, all were from large "prime" type companies. The second workshop included mid-size suppliers and small businesses to round out the information gathering. In the "prime-centric" view of the issue, contractual relationships of the business entities were presented in diagrammatic form in an attempt to explain and analyze the interfaces. The simplest form of the relationship (Figure 1) was that of the prime contractor's relationship with the customer and the supplier, where the requirements were flowed down along this food chain in both the principle acquisition and the "after market." The "after market," of course, would be open to other companies than the OEM as is the case in the "breakout" program.

The second relationship could be explained as an amplification of the previous relationship. This representation added the universes of non-traditional suppliers and customers (other than the DoD) with the OEM acting as the prime interface, but where



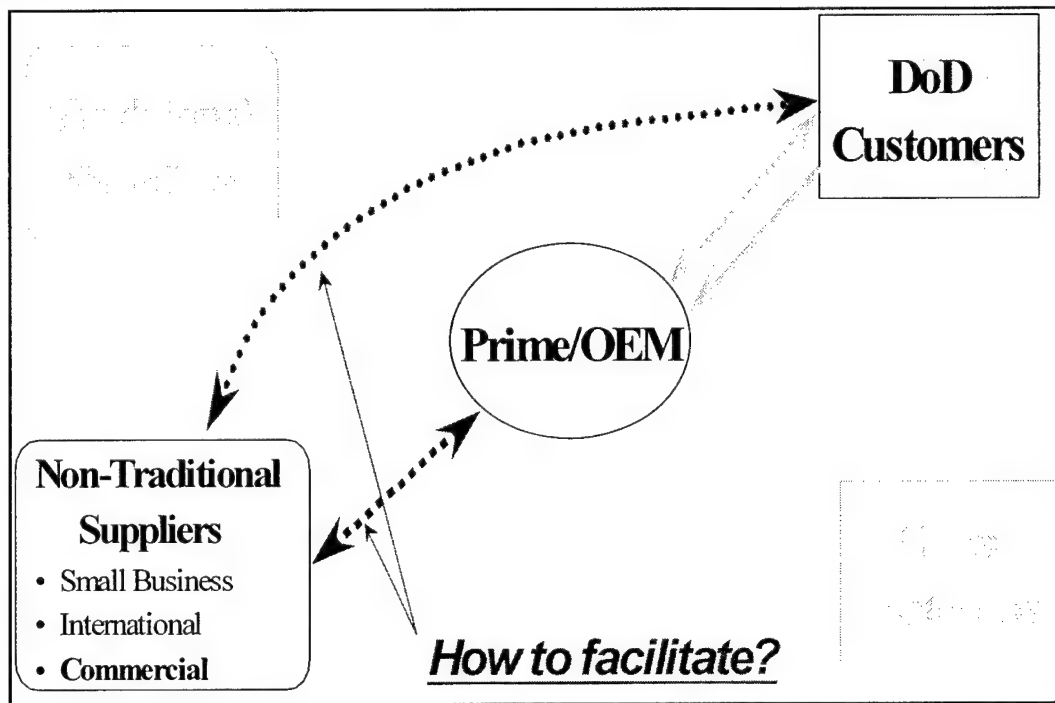
the military requirement and a cost based contractual relationship was contrasted by the commercial business model “best value for an offered price.” See Figure 2.



*Figure 2. Contractual Relationships including the “Non-Traditional”*

Ideally the technical dialogue-taking place between the five entities of the universe would allow for an exchange of information and therefore sufficient knowledge into the availability of current technologies. But since this was one of the unknowns going into the workshop, workshop discussion would clarify the issue. More specifically, in the opening presentation of the “prime centric” explanation of the perceived situation, the question of “how better to facilitate the visibility and access between the prime/OEM, the DoD customer and the non-traditional supplier” was posed (See Figure 3). It was assumed that the present level of access and visibility into non-traditional supplier technologies was less than that which could be achieved.

The general discussion that ensued after the notional ideas had been presented revolved around several of the ideas postulated. The dialogue was lively and the participants not taciturn.



*Figure 3. Improving Visibility and Access*

### Prime Centric View Dispute

With regard to the knowledge of technologies available, many of the roundtable participants agreed that there might have been a less clear view of technologies available to defense acquisition several years ago. Workshop discussion highlighted that, prior to acquisition reform and the implosion of the Aerospace Industry companies, were more involved in their own specific program technologies. Furthermore, a "prime" is not considered today what a prime was considered before acquisition reform. The aerospace consolidation has caused concentration and condensation of technical dialogue to a degree sufficient for the OEM's to understand what technologies are available throughout a greater universe than ever before. In addition, these OEM's have greater knowledge of the technology utility to the systems where they are applicable. It was brought out in discussion that the larger problem lies in the rapid turnover of technology (less than 18

months generally recognized) and the inability to identify, characterize, evaluate, certify and insert in a manner timely enough to make sense and achieve cost breaks. This technology insertion problem is compounded by the fact that the DoD generally represents less than one percent of customer requirements of the private sector. So, in most cases, the driver of commercial technology is the consumer. With regard to technology for defense, the consumer's needs may not parallel the requirements of defense. In most instances there is no parallel. Where there is a parallel, the incorporation of technology runs headlong into a number of barriers, by no means the least of which is intellectual property rights.

Traditionally the Government has sought and received rights to data, re-procurements, cost data, and insight into the very material structure of the systems that the primes and their suppliers created. While the technology far outpaced the rest of the world (it is still indisputable that US weapon systems have enjoyed a considerable margin of technical superiority over other nations' weapons systems) the technology could be shared throughout the defense sector. Leading edge technologies were known to everyone, especially the prime's competitor. Competitive advantage in defense procurement on the part of defense companies participating in the past two generations was not based on affordable technology. Prime contractors became competitive by nurturing their respective core competencies that involved precise articulation of company capabilities in responding to requests for proposals, by reflecting customers desires in specific management systems, and by creating large, mirror-image company infrastructures to deal with defense program management and oversight organizations.

Willingness and attractiveness to pursue non-traditional sources of technology was generally not stifled by a reluctant prime. More-than-likely it was the reluctance of the non-traditional source to participate because of the invasive process required to do business with the defense system. If any non-traditional sources are to be attracted, it is believed that there would be a need to further relax the stringent requirements of contracting with the government. The current reforms in the acquisition process have started breaking down these barriers. Certainly the ability to use innovative contracting vehicles such as those used by DARPA, the "Other Transactions Authority" (OTA)

demonstrated the potential of using non-traditional source technologies without bumping into the intellectual proprietary rights issue.

### **Intellectual Property Rights**

One of the most vociferous arguments regarding barriers to capturing non-traditional technology for defense use was that of intellectual property rights. Immediately picked up as "a barrier-not-on-the-list" was how the department historically views its right to have full access and information to data which most companies feel are proprietary. It was unanimous among the Industry participants that whatever size or level company, prime or small, the better way to encourage access to technology was to limit the government's right to data and intellectual property. Many companies feel this intrusion is a major barrier, particularly small companies who feel that their company's competitive advantage is their technology. Companies agree they put their competitive advantage in jeopardy by doing business with the government directly or as a subcontractor or supplier to a prime company providing product or service to the DoD, because of the government's insistence in knowing all the technical data involved.

### **Technology "Scouts" & "Bounty Hunters"**

If the notion of intellectual property rights was identified as a major barrier with the Industry participants, the idea of a third party technology bounty hunter or technology scout was posed as an even greater barrier. Who would be responsible if a third party were now involved with trading what could be the discriminating competitive technology? Who would be accountable for allowing critical competitive technology from slipping into the hands of a competitor? How could one be assured that any one company's technology would make it to a defense system any quicker than another company's if a third party were involved? What would be the limits of liability and responsibility of a Government technology scout? What assurances are there that the "scout" would be better informed than the company he is scouting? The argument was made that small business innovative technologies are not accessed as best as they could be. But who would be best suited in the responsible position of accessing companies'

technologies, the government or the prime? If the prime couldn't perform that function well, why would anyone assume that an entity not in the normal communication network would be able to? Recognizing that a vertically integrated company might not be as willing to share technology or to seek outside technology, the Industry team members pointed out that this situation would always be secondary to delivering the best system to the customer. Providing your customer with the best possible product, technology from whatever the source included, was paramount to success.

## **Flowdown Requirements**

Flowdown requirements imposed by the Government on the prime, and thence prime to the sub-tiers, had more effect on stifling technology flow between prime and supplier than any company self-interest motives. Some good subcontract and company paradigms with regard to contract and subcontract administration and supplier/vendor mentoring will have to change to take into account the new acquisition environment we are striving to achieve. And the degree of trust between Government and Industry has to continue to move closer if the solutions to affordability we seek are to come to fruition.

## **Testing**

Testing was brought up in the conversation as another barrier that if removed had potential for improving technology flow to defense systems. The testing concept was discussed as having two separate functions: Qualification testing and Operational testing. The difference in the two for the purposes of this discussion was analogous to certification for requirements compliance (Qual Test), and "test driving" a product (Ops Test). The current mode of operations in defense systems requires extensive qualification testing for every system. If a system is changed or modified, re-qualification is necessary. If the timing of these two steps is out of sync with the program's acquisition timetable, the latest development in technologies may be avoided. It was also offered, somewhat tongue-in-cheek, that this barrier grew larger if "Type A" personalities were involved in the decision process. As flip as that remark may have been taken, there is a certain amount of recognition to the new "partnering" attitude that will have to be

accommodated if new ground is to be broken to achieve affordability. The notion of collaborative testing or consolidating test requirements between the two communities to take advantage of similar test facilities and closely related testing activities of the other test community.



As the discussions progressed it became apparent that the barriers being discussed were repetitive and relevant to several issues. In an attempt to capture these thoughts and suggestions, a situational catalogue of four general areas was made from the perspective of both Industry and Government (with all participants opining). A "Red," "Yellow," or "Green" subjective assessment was given to each category to indicate the participants' view as to whether there were problems from either viewpoint that required further discussions or solutions. Red indicates an inadequacy, yellow indicates a marginal issue, and green indicates that there is no perceived problem.

### **Issues Matrix**

The categories were further broken down as deemed necessary to more adequately describe the issues. After the original "Issues Matrix" was completed, the exercise evolved into determining both the barriers that inhibited technology transfer and potential enablers that could possibly alleviate the situation. This matrix is depicted in Figure 4.

The four categories of the Issues Matrix include:

1. **Knowledge**, alluding to the question of, "Is there sufficient knowledge of commercial technologies to allow migration into defense weapons systems?" Referring to the matrix, and with the perspective of each group represented (Industry and Government) it was determined that there were no inadequate issues (excepting intellectual property rights, recognizing some technologies would never be available to defense, and excepting technology exploitation that could be effected if knowledge existed). This area was rated "Green" by all indicating that there was sufficient knowledge on the part of Government organizations and Industry that would preclude the necessity of third party brokers, bounty hunters, or facilitators and the infrastructure that would service them.

	Industry (Prime)	Government (DoD)
<b>KNOWLEDGE</b> •Not only Int Prop Rights •Some Techs not avail •Tech Exploitation	<b>G</b>	<b>G</b>
<b>EVALUATE</b> •Qual •Need •Tech Cycle Time	Testing <b>R</b>	Testing <b>R</b>
	Test Drive Y	Test Drive Y
<b>SUSTAINMENT</b> •Architecture •Long Term Approach	Y	<b>R</b>
<b>PROCUREMENT</b> •Timing •Competition •Resources		

**Figure 4. The “Issues Matrix”**

2. **Evaluate**, which addressed the question of: “Were testing requirements overly burdensome, causing a chilling effect on commercial technology migration?” Referring again to the matrix, both types of testing that were explained earlier were addressed. Qual-testing was determined to be a major inadequacy in terms of allowing the quick migration of commercial technology to defense systems. Operational Testing, on the other hand, was determined to have made some progress in allowing technology migration from the commercial sector, thus it was coded “yellow” to indicate there were still some opportunities to improve.

3. **Sustainment**, which took the form of questioning the present architecture and long term aspects of providing technology for the legacy systems, “Does the current activity in sustainment allow for the identification and insertion of commercial technologies in current operational systems?” The Industry perspective with regard to the ability to identify and use any technology for the upgrade modification and overhaul of current

systems can be improved upon, hence a "yellow." From the government perspective resource impediments (different programs - colors of money) present a hindrance, purchasing of technology from international sources is difficult and there are a multitude of Diminishing Manufacturing Sources issues and "last time buys" that inhibit the introduction of commercial technologies.

4. **Procurement**, which addressed a series of questions or sub categories revolving around the current acquisition reform successes, "Does the current acquisition system, with acquisition reforms in place, make the transition of commercial technology to defense any easier than in the past?" Initially, three subcategories made the list, then as the conversation grew it was noted that there were a number of issues in the procurement category. Both viewpoints continued to add sub-elements until there were nine separate items. (See Figure 5)

	Industry (Prime)	Government (DoD)
<b>PROCUREMENT</b>		
• CAS	—	Y
• COST/PRICE	—	Y
• TIMING	Y	<b>R</b>
• RESOURCES	<b>G</b>	<b>R</b>
• INT'L PROP	Y	<b>R</b>
• SBA	—	Y
• FLOWDOWN	<b>R</b>	<b>R</b> (Y)
• CERT	—	<b>R</b> (Y)
• CICA	—	<b>R</b>

*Figure 5. Sub-element "Issues Matrix"*

The "solid line" shown for the Industry viewpoint recognizes that the organization effecting any change to **Cost Accounting Standards (CAS)** and the determination of



**Cost vs. Price** resided solely in the domain of the Government's authority and ability to change. The government perspective rated "yellow" indicates that while some changes to the CAS have been made and some changes in the "cost plus" mentality have occurred, there still was room for change. Timing from the Industry perspective is "yellow" because there are still some improvements possible that will allow a faster realization and incorporation of technologies on the part of the companies that are integrating the components and software of the systems. However, from the Government viewpoint, the timing issue is rated "red" in recognition of the excessive amount of time it takes for the procurement process to wend its way. In spite of the many acquisition reforms instituted, the normal process still requires months of proposal activity, review and evaluation, source selection, etc. in a ponderous system that allows technology (whose half life is shorter than buttermilk) to be passed because of being out-of-phase with procurement phasing. Company **Resources** can be applied to technology capture far quicker than government resources that require appropriation, authorization, execution, and reprogramming, if technology changes within the cycle, on a year-to-year basis.

**Intellectual Property Rights** and rights in data, explained earlier, received "yellow-red" to indicate that there are still problems to be addressed with respect to company involvement, but many more issues to be addressed with regard to government solutions to the lowering of existing barriers. **Flowdown** was rated "red" in both perspectives acknowledging the burdensome contractual requirements imposed on prime contractors by the Government and also the burdensome process handed to the second tier structure by the prime notwithstanding any accommodations made by the Government through acquisition reform. Prime contractors still burden their supplier/vendors with unnecessary requirements. **Small Business Activities (SBA), Certifications,** and the **Competition in Contracting Act (CICA)** effect the migration of technology substantially but can only be remedied by the government.

## **Barriers and Enablers**

Each of the categories with a "red" or "yellow" indicator was then further discussed to identify the barriers that caused a "Y" or "R" assessment. Where a barrier was identified, at least one "enabler" was solicited for to indicate possible remedy. These Barriers and

Enablers are shown in figures 6 through 8 for the three issues: Evaluate, Procurement, and Sustainment. (Since “**Knowledge**” was determined “Green” no further discussion into improving knowledge conditions was taken on.) The barriers identified in the three other categories represent the perceived areas that require attention. While “enablers” have been assigned to each of the barriers, this is an interim action.

It was anticipated that there would be another workshop round, which will address similar issues from the perspective of subcontractors, vendors and material suppliers. It is critical that we reach as complete an understanding of the barriers as possible throughout the entire vertical enterprise. The follow on workshop included representatives from mid-level and small businesses. The enablers associated with overcoming these barriers also required examination in terms of the “food chain” during the next workshop round. The potential for pilot programs to address the entire condition will be discussed subsequent to the information gathering along the food chain. Additional effort will be conducted to match these potential solution ideas to current activities or initiatives designed to increase commercial technology insertion into defense systems.

	<b>BARRIER</b>	<b>ENABLER</b>
<b>EVALUATE (Test)</b>	<ul style="list-style-type: none"> <li>• QUAL TESTING</li> </ul>	<ul style="list-style-type: none"> <li>• VENDOR/SUPPLIER Need Based Test</li> </ul>
	<ul style="list-style-type: none"> <li>• RIGID STATUTORY RESTRICTIONS/POLICIES</li> </ul>	<ul style="list-style-type: none"> <li>• MOD &amp; SIM Share Test Data</li> <li>• Convincing S.E. Capability</li> </ul>
	<ul style="list-style-type: none"> <li>• IRON MAJOR Syndrome</li> </ul>	<ul style="list-style-type: none"> <li>• Culture Change Educ/Tng Program</li> <li>• CAIV to DEV</li> </ul>
<b>EVALUATE (Test Drive)</b>	<ul style="list-style-type: none"> <li>• Reluctance to Accept UNSOLICITED PROPOSAL</li> </ul>	<ul style="list-style-type: none"> <li>• FUNDING FLEX</li> <li>• CHG REPROG RULES</li> <li>• MARKETING TO HILL</li> <li>• EVOL DEF ACQ</li> <li>• RAP (Process Expand)</li> <li>• SHIFT TO VALUE BASE ACQ</li> <li>• MOTIVATE ACQ COMM</li> <li>• PRUDENT RISK MGT</li> <li>• TECH ROADMAP</li> </ul>

*Figure 6. Evaluation “Barriers/Enablers”*

	BARRIER	ENABLER
PROCUREMENT	• ACQ REFORM	• TRAINING & EDUC • COM'L BASED DEALS • SPI • PILOT PROG (Transition Issues - Scale Up?)
	• INTELCT PROP RIGHTS SOURCING ISSUES {	• ANTI BREAKOUT • DEFINE F3I/CONFIG MGT • TRANSFER/LICENSING • TIME DELAY INTL PROP • TOT LCC SUPPTD BY OEM • BETTER DETERMINATION OF VALUE • MOVE TO "PRICE"
	• GOV'T FORCED	• PBBE • SPI • CLEARER ANNUC OF COM'I • ITEMS IN GOV KIT

	BARRIER	ENABLER
Procurement (cont.)	<b>Small Business</b> • TERMS OF REF • LEVELS OF REQMTS • GOV'T "DATA BASE" REQMTS  • SBA PAPER TOO DIFFICULT	• RELAX REQMTS • RELAX AWARDS • DIFF ACC'T METHODS • STD EXEMPT FOR PURE COMM'L COMPANY • SBIR MODEL ? • MORE DIRECT SUPORT THAN PROGRAMMATIC DATA • MENTOR/PROTÉGÉ?  "A BUSINESS DECISION"

*Figure 7. Procurement "Barriers/Enablers"*

<b>SUSTAINMENT</b>	<b>BARRIER</b>	<b>ENABLER</b>
	<ul style="list-style-type: none"> <li>• CAN'T BUY INT'L</li> <li>• EXPORT LIC</li> <li>• OUT-OF-BUSINESS "LAST TIME BUY"</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• SUSTAINMENT "PROCUREMENT ISSUE"</li> </ul>	<ul style="list-style-type: none"> <li>• RELAX RULES ?</li> <li>• RELAX REQMTS</li> <li>• EXAMINE CARRYING COSTS</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• JOINT MANAGED PROG</li> <li>• TOTAL LIFE FOR SYSTEM "A BUSINESS DECISION"</li> </ul>

*Figure 8. Sustainment Barriers/Enablers*

## **“Tiered View”**

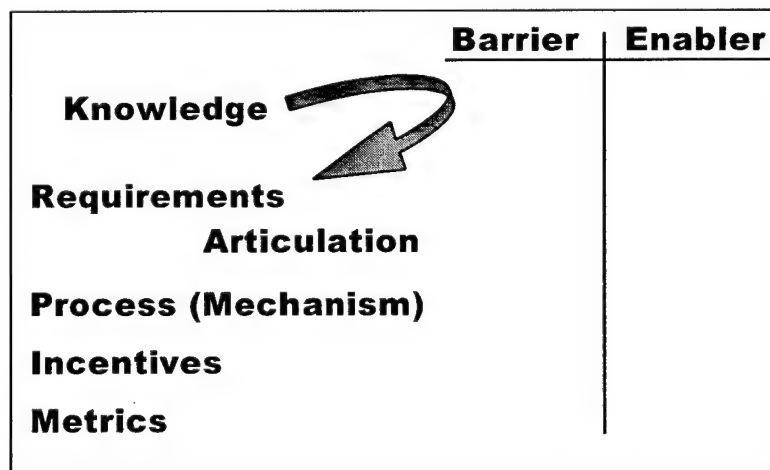
Continuing the effort to identify and incorporate technologies that are rapidly developed and marketed in the commercial marketplace, the second workshop focused on the suppliers and material providers and on the unique problems they encounter when trying to get their products into DoD systems. This workshop also focused attention on the ideas brought to the table by companies that normally did not participate in defense weapon systems acquisition or had the majority of their product developed and sold in the commercial market place. The workshop's objectives were similar to the preceding workshop:

- Attempt to reach a shared vision of the issues
- Attempt to reach an understanding of the barriers that exist today.

No attempt was made during the workshop to “validate” the proceedings and comments of the proceedings of the previous workshop. In looking at the issue from the “opposite” view (non-traditional and 2<sup>nd</sup> Tier) the group was asked to identify any additional impediments (if there were any) and to further focus on “how to remedy” any barriers that were identified. In fact, the second workshop participants, by having the advantage of reading the proceedings from the first workshop as preparatory information (“read-ahead material”) questioned the notion of either Government or Industry having the ability to understand and have knowledge of the total picture of technology throughout the commercial and defense sectors. Therefore “Knowledge” which was determined to be “Green” and not discussed at length in the first (Prime-Centric) workshop, was discussed in a somewhat different light during the “Tiered View” workshop. The conversation held that “everyone did not and could not know the amount of and level of technology available in the commercial sector.” However, more knowledge could be gained if the requirements for various technologies, the “needs,” were articulated by those in charge of defense programs as they typically were in commercial projects. If these requirements were couched in terms of “cost drivers” (especially in the operations and support of legacy systems) a more precise focus on technological solutions might result. Program Managers typically do not share their technology needs with Industry

except for the prime level companies in the DoD traditional acquisition process. Nor have they highlighted their cost drivers with regard to operations and support. There is also no conduit for any company, aside from the prime level defense company, to make generally known the technologies available to defense weapons systems any earlier than a competitive action. In spite of these facts, this group echoed the previous workshop by disclaiming any need for government guiding hand “bounty hunters” or “technology wardens.” “Another Government agency created to assist technology migration is not the answer,” was generally the feeling of the group. The answer probably lies in modifying or doing away with barriers put in place by the existing structure which includes participants from the private sector—companies that have participated in Government acquisition for many years, have a core competency in Government acquisition, and are comfortable with the existing process.

“Knowledge” as a discussion criterion was converted into “Requirements Articulation” as a category for discussion. (See Figure 9)



**Figure 9. “Second Tier View” Workshop Discussion Criteria Areas**

The workshop discussion period then revolved around the four areas shown in Figure 9:

- (1) Requirements Articulation—how the technology needs are broadcast;
- (2) The Process (or Mechanism)—by which the technology can be brought in to the government program;
- (3) Incentives—for conducting business with these ends in mind, and

- (4) An attempt at defining measurements (Metrics) of whether or not this general concept of utilizing commercial technologies in defense systems is beneficial.

To stimulate ideas and start the conversation headed in the direction of commercial technology use in defense, Mr. Rich Mirsky of the Joint Dual Use Program Office presented a briefing regarding "Spin On." (A copy of the briefing is provided at Appendix 3.) Embedded in this briefing was an explanation of the Commercial O&S Savings Initiative (COSSI), the DoD program that addresses "spin on" for legacy systems, but with the primary objective to reduce O&S costs. While not specifically aimed at improving the process by which commercial technology can be brought into weapon systems programs, the process COSSI does use to integrate commercial technologies is unusual and different from the traditional defense acquisition process. COSSI imbeds commercial technology in an interface "wrapping" that makes it compatible with the system it will support. Through a "cost shared" project using the "Other Transactions Authority" (Sect 845/804), Industry inputs are sifted for selection, then prototyped, tested and qualified as part of a "first phase" of this two-phase initiative. The second phase covers the procurement by the military customer of "kits" produced by the contractor using the commercial technology and the interface wrapping developed in phase one. In this part of the process, a traditional DFAR contracting approach is followed, usually on a "sole-source" basis for the procurement of the kits. The attraction to the private sector is the formula of cost shared development followed by a stable follow-on sales program. It was thought that perhaps some or all of the mechanisms of the COSSI could be applicable to generally spin on commercial technologies.

## **Requirements Articulation**

Although reported differently in the "Prime Centric" workshop, there was general agreement among the participants of workshop two that there was not necessarily an overall "general knowledge" of the technologies available to the market and therefore to the defense weapon system program office. Further defining "knowledge areas," this group differentiated between "Existing Programs" and "Future Systems." There was, however, a common thread between the two. In both cases it was determined that the responsible program manager needed to make the needs of the program (both legacy and

future) known to all program participants. Extrapolating from the COSSI program (a model of incorporating commercial technologies for operations & support) articulating technology requirements of an existing program (not in upgrade or overhaul) would necessitate including those existing programs that were “new-on-the-books” like F-22, New Attack Sub, Comanche. Other future systems needs should also be articulated, to round out the total picture of technologies needed to maintain our warfighting “decisive edge.” There were barriers to this knowledge exchange however. These barriers manifest themselves as insufficient information of what’s needed; not all program managers and not all Industry counterparts know where the technologies are and more importantly what specific technologies are needed to solve particular defense weapon systems problems. Two factors were identified as being largely responsible for this occurrence. There is reluctance by the defense institution to share sufficient information on requirements and needs to the US Defense Industry early enough in mission conceptualization to have a complete understanding of technology needs. There is also a general reluctance on the part of prime contractor companies to engage in technology relationships with companies other than their strategic partners or those with whom they had long term program relationships.

Barrier	Enabler
<p><b>Requirements Articulation</b></p> <p><b>Existing Programs</b></p> <ul style="list-style-type: none"> <li>• <b>Insufficient Information of What’s Needed</b></li> <li>• <b>DoD Reluctance to Share Info</b></li> <li>• <b>Prime Reluctance</b></li> </ul> <p><b>Future Systems</b></p> <ul style="list-style-type: none"> <li>• <b>Timing</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>PM Articulate “Top Ten” Cost Drivers</b></li> <li>• <b>Organize Information by: Program Hardware Technology</b></li> <li>• <b>Simulation</b></li> <li>• <b>Catalogue Current Capability</b></li> <li>• <b>Roadmap Evolving Technology</b></li> <li>• <b>Open Systems</b></li> <li>• <b>Simulation</b></li> </ul>

*Figure 10. Barriers and Enablers to Achieving Articulation of Knowledge*



Defense Department reluctance is generally manifested by cloaking requirements in "classification." Prime contractor reluctance shows up as "competition sensitive" or "proprietary," and sometimes is perceived as arrogance by companies that are not within the strategic partnership or close community. There might be occasions where prime contractors have an interest in maintaining those barriers to limit their competition. As to the barriers to technology needs of future systems, timing may also provide a significant hindrance. Technological breakthroughs may just not be able to be predicted to allow an easy transition.

Similar to the first workshop, the ground rules of the "tiered view" workshop required that if a barrier were brought up, a suggestion of a potential remedy would have to be considered. These possible enablers, methods that could take away, or ease the barriers were among the survivors that were suggested. Viewed in the illustrations, the barriers and enablers do not necessarily "track" one-for-one, but generally follow a logical pattern of problem-recommendation.

Several "Enablers" were suggested to assuage the hindrances. In both workshops, and in more than one of the one-on-one interviews, prime contractors were identified as having key roles as enablers or inhibitors. As noted earlier, there were anecdotal instances brought out in both sessions that alluded to prime contractors having a "technological arrogance" that could inhibit sub-tier companies from offering new technological solutions. If not technological arrogance, competition and the need to prevent competitors from obtaining and understanding discriminating technological competitive advantages might go a long way in explaining the impeded flow of state-of-the-art technical information. To enhance the knowledge of program's needs, each major weapon system program manager should be required to explain what were the top ten cost drivers impacting their program. In attacking these top ten cost drivers, possible technology solutions (and the coincident technology) might emerge. Understanding of the needs could be further clarified if the disseminated information were organized by program, hardware and technology. Simulation could also play a greater role in advancing technological solutions because of the rapid running of trial cases and the "what if" fluidity that it provides. Future simulation activities will need to incorporate

more physics parameters than modeling and simulation routines typically provide today. With regard to future systems, the participants thought that timing was again a key issue in knowing what was available to be incorporated into a future weapon system. A new program "waiting" for technology development could prove to be very expensive. On the other hand, a system whose technology is not "state-of-the-art" would probably not be successful on the battlefield. The "enablers" offered to offset the articulation barriers for future systems took the shape of a catalogue of current capabilities, and a "roadmap of evolving technologies." Simulation again was thought to be advantageous in solving future systems problems, and an "Open Systems" approach would certainly facilitate the interface issue.

### **Process (The Mechanism)**

The second topic area addressed was the methodology of gathering commercial technology to be incorporated in defense systems. This group also recognized that it was generally difficult to do business with the Government. Rules and regulations more stringent than the commercial marketplace were definite barriers to spinning on technology. There are, however, models of successful programs that could be emulated or modified and piloted for inspection and potential future institutionalization. The "Other Transactions Authority" (OTA) is one of these processes. The Defense Advanced Research Projects Agency (DARPA) has successfully used this congressional authority to circumvent much of the traditional Defense Federal Acquisition Regulation (DFAR) process in the pursuit of their high tech projects. Not only is the cycle time situation addressed in the OTA method but the notorious, voluminous, paper mill requirement is also bypassed—beneficially, in the critique of most of the companies that have participated in these types of projects. OTA authority has recently been granted to the DoD, and could be a potential "Enabler" to "Spin-On" (and other acquisition reform activities as well) but the process does not appear to be well understood by the contracting community yet. With the lack of understanding is the attendant reluctance to "try something new" or take any risk that could result in potentially career-impacting errors. Additionally, DOD's authority to use this streamlined program execution approach is limited to "prototypes" only. Although there have been some imaginative

definitions used to define “prototype” this restriction still limits the use of this mechanism.

<b>Barrier</b>		<b>Enabler</b>
<b>Process (The Mechanism)</b>		
<ul style="list-style-type: none"> <li>• <b>Other Transaction Auth</b> Not Understood by ACO's Only “Prototypes”</li> <li>• <b>Elec Commerce</b> Incompatible Systems</li> <li>• <b>ECRC</b> May not have “sense of mission”</li> <li>• <b>COSSI</b> Still needs “Cost Drivers”</li> <li>• <b>Marketing by Commercial Supplier</b> Agony of Gov't Contracting</li> <li>• <b>Qualification</b> Characterization/ Compatibility</li> </ul>		<ul style="list-style-type: none"> <li>• <b>Market the OTA, facilitate use</b></li> <li>• <b>Relieve ACO Pressure</b></li> <li>• <b>Team w/ Company previously “through the hoops”</b></li> <li>• <b>COE's Interface ECRC's</b></li> <li>• <b>Imbed “Cost Driver” Req in COSSI Program Solicitation</b></li> <li>• <b>Company Paradigm Changes/ ACO Pressure Relief</b></li> <li>• <b>Company Qual &amp; Warrant</b></li> <li>• <b>Commercial Standards</b></li> </ul>

*Figure 11. Barriers and Enablers Associated with the Process (The Mechanism)*

Several enabling suggestions were discussed with regard to the OTA. Generally it was thought that an increased program of awareness and training in the use of the OTA would eventually wear away the reluctance to use it. It was also suggested that a concerted effort to “market” or encourage its use by defense leadership would have beneficial results in encouraging its increased use. All agreed that additional progress in using the OTA would result from making it a more non-threatening method, that is, providing the environment to allow some margin for error in the contracting community that has been using DFAR processes for two generations. Companies would also have to change, and the allowance for risk taking would need to be increased within the Industry contracting community (which has also built up a core competency of contracting within the FAR). Perhaps a “mentoring” approach for new technology might assist in increasing the comfort level in using OTA. As an example, teaming with a company that has used OTAs in a prior government project might be an easy way of “learning the ropes.”

Not all suggestions of the workshop fell on fertile ground. To illustrate, the use of electronic commerce was brought up as a potential methodology for facilitating the spin-on of technology. More in-depth discussion determined that today's electronic commerce (perhaps with the exception of billing and invoicing) had too many incompatibilities to allow it to be used as a conduit for technology spin-on. It was also offered that the DoD Centers of Excellence might be a potential interface to electronic commerce through the Electronic Commerce Research Centers (ECRC's). Further discussion pointed out that the ECRC's may not share the same "sense of mission" in spinning on technologies throughout the entire spectrum of requirements. The Manufacturing Centers of Excellence (COE) was included in the discussion. Although the COEs might focus on specific technology areas and could potentially be of use in this area, there is no coordinating interface between the centers.

If the COSSI process were used as a model for spin on, the apparent success it brings to the operations and support community could be the enabler for both existing programs and future systems. However, COSSI needs to be more stable in the pursuit of its own program, and COSSI would be improved if the cost drivers were identified and focused upon. The suggestion to imbed cost driver analysis not only was applicable to the "Spin-On" concept, but was suggested as a major improvement to the COSSI program itself.

One of the major barriers to bringing on commercial technologies into defense products is the rigorous qualification process that is part of the defense acquisition process. New commercial technology insertion into new defense programs would appear on the surface to be easier to achieve because insertion into the qualification process itself would occur when the timing was right. Insertion of technologies from the commercial arena after design and production decisions (e.g. overhaul and repair, upgrade spares etc.) poses other problems. Better characterization of commercial parts still needs to be done to insure compatibility of commercial piece parts with current legacy systems architecture. There have been instances of new commercial parts, characterized as having the same parameters and specifications as the part they replaced, unable to function with the system in which they were inserted or which rendered the entire system inoperable. This is a recognized major barrier that requires separate and in-depth study. The workshop

participants suggested that individual company qualification methods, along with strong, well-crafted warranties, would be preferred over a Government office oversight of qualification. Incorporation of commercial standards and specifications appear to be a viable enabler but would have to be researched, and tracked for long term robustness in defense use.

The transition from Government specifications to commercial standards is not yet complete. Consistent application of qualification parameters must occur before defense systems can completely rely on commercial technology insertion. For example, it was pointed out in the workshop that there does not appear to be consistent application of commercial standards (ISO 9000 in this case) by the DoD. This situation could cause non-traditional suppliers additional problems in doing business with the government and with their primes.

## **Incentives**

The discussion regarding incentives to attract more commercial technologies for defense consideration revolved around the topics listed in Figure 12. Return on Investment (ROI) was the first topic discussed. ROI, to a company participating in Government programs, generally means no more than 13% profit. Many commercial companies do not even entertain entering into a market when the preliminary business case reflects these low profit margins. Internal "hurdle rates" (minimum estimated rates of return required by company management to continue pursuing a sale) can range as high as 20 to 25% with actual profit margins reaching considerably higher. In order to be competitive for the commercial company's attention, profit levels will have to be allowed to seek the level of the market place. The subject of unconstrained profit is a major break from traditional government acquisition and will require substantial change in the culture of defense acquisition. Enablers that can help the migration to commercial activities are "price based" and "best value" contracting. Although the idea of price vs. cost is somewhat understood as a potential driver in acquisition reform, the change from "cost" to "price" mentality has not yet been sufficiently embraced at the cultural level necessary to make a difference. A lot more work has to be done to achieve total acceptance, including

education, training, and senior leadership acceptance, example and advocacy. One of the suggestions that could help in achieving this paradigm change is the change of emphasis from ROI to companies to "what is the ROI to the Government customer (program or system)." This change in emphasis can help change the mindset of the leadership in defense who still see a conflict of the ideas of price based acquisition and guardianship of the public trust. Parametric price models and market survey price models can assist in allaying the government customers' fears of spending too much for an item (product, system, etc.) but the key to the change is building greater trust between Industry and Government.

## **Data Rights**

A key trust issue to be taken on is the data rights issue. Historically, rights in data went to the Government buyer of a contractor's goods and services. One of the by-products of this process was that companies increased costs to offset loss of intellectual property. Another by-product was a more-than-arms-length approach to doing business with the government customer and other company team members. If nothing else, the transfer of technology across sectors was inhibited because of the reluctance to give up intellectual property and competitive advantage. Companies rightfully protected their intellectual property from all eyes. The Government, on the other hand, had a legitimate reason for data. To insure future repair and servicing of components and systems when the OEM or original supplier no longer produced or serviced the part or system, the Government system managers believed they needed to have the ability to recreate or remanufacture the spares and modifications to sustain the fleet and the force. Commercial companies shy away from dealings with the DoD because of the requirement to provide data. To enable the migration of technology from the private sector, it was suggested that the approach of "everything is negotiable" might be the starting block for doing away with government requirements for rights in data. Obviously the simplicity of this enabler would require that there be strong advocacy for the idea in the senior ranks of the DoD, and a stronger trust between all participants would have to be built.

Program stability is a notion that rises to the surface time and time again. Generally it reflects the availability of resources which, in turn, points to the level of Congressional support for any one program or budget category during the annual Planning, Programming, and Budgeting System (PPBS) process. As is the case with all defense programs, resources that are consistently applied to programs for the long term can be planned and executed better and generally cost less. Programs with stability and longevity are prized in the private sector. Company activities in any commercial product area are planned to last to the end of the market run, with follow on market activity seen as beneficial. However, defense resource allocations typically change several times in one year, and can fluctuate orders of magnitude across program lines throughout a program's life. Stability of programs can do much for technology transition as well as effecting substantial changes in cost, schedule and quantity. It is a simple concept that continually eludes the defense acquisition community. It just needs to be done. The workshop group allowed that the only way to accomplish this enabler was to legislate program stability. Several years ago multiple year program funding was instituted. Perhaps the next stage in trying to achieve program stability is to convince the resource managers to address the funding for the program as a singular, packaged issue.

Barrier	Enabler
<b>Incentives</b>  <b>Return on Investment</b> <ul style="list-style-type: none"> <li>• Limit of 13%</li> </ul> <b>Data Rights</b> <ul style="list-style-type: none"> <li>• Gov't Retention</li> </ul> <b>Future Business Base</b> <ul style="list-style-type: none"> <li>• Certainty of Future Business</li> </ul> <b>Technology direction</b> <ul style="list-style-type: none"> <li>• Resources Available</li> </ul> <b>Program Managers</b> <ul style="list-style-type: none"> <li>• Savings Lost to Program</li> </ul>	<ul style="list-style-type: none"> <li>• Price Based Contracting</li> <li>• Value Based Contracting</li> <li>• Change to "ROI to Gov"</li> <li>• Parametric</li> <li>• Market Survey Pricing</li> </ul> <ul style="list-style-type: none"> <li>• Everything Negotiated</li> </ul> <ul style="list-style-type: none"> <li>• Legislative Change</li> </ul> <ul style="list-style-type: none"> <li>• Risk Mitigation/Cost Sharing</li> </ul> <ul style="list-style-type: none"> <li>• Program retain resources for Program Decided Effort</li> </ul>

*Figure 12. Barriers and Enablers Relevant to Incentives*

The idea of recouping cost savings to the benefit of the program has also been offered as an incentive for several innovative approaches to acquisition problems. There is a lot to be gained by allocating management savings resulting from risk taking innovation. If a program manager sought to solve a problem by using commercial technology and the choice resulted in savings to the program, and the program was able to retain the resources saved for application to other problem solving, risk taking ventures, it is intuitive that more program managers would attempt to use this method. This is an idea that does not have a model for capturing the returns. That model should be developed and demonstrated.

## **Metrics**

The need for "figures of merit," or measures of effectiveness, goes along with the generation of new ideas and projects no matter what they are. Developing such metrics is seldom easy. There were three areas the workshop participants agreed were relevant:

- (1) Increasing the level of commercial technology use by defense companies,
- (2) Increasing the participation of 2nd and 3<sup>rd</sup> Tier and non-traditional companies in defense programs, and
- (3) Changing the size of infrastructure as a result of incorporating reforms, and recouping the savings attendant in the restructured organizations.

The barriers to measuring each of these notions are:

- (1) As discussed earlier, the reluctance of a defense company to use outside intellectual effort is a barrier to any change. It would particularly be evident in the embracing of commercial technology.
- (2) Government intrusiveness is the primary reason many commercial companies shy away from business with defense programs.
- (3) Any savings recouped in government programs typically are captured back at US Treasury level. This barrier requires a major change in regulation and legislation in order to be overcome.



Given the success at overcoming these barriers by affecting these enabling “fixes,” the metrics would then be gathering the information on:

- Prime Contractor Use of Commercial Technologies -- How many instances and what kind
- New companies’ entry and involvement in defense contracting -- How many companies and to which primes did they find it easy to enter into business with.
- Changes in size and structure of company organizations as fallout from commercial technology insertion.

Barrier	Enabler
<b>Metrics</b>  <b>Change in Amount of Prime Use of Commercial Technologies</b> <ul style="list-style-type: none"> <li>• Prime Reluctance to Change</li> </ul> <b>Change in Amount of New 2nd/3rd Tier Companies</b> <ul style="list-style-type: none"> <li>• Government Intrusiveness</li> </ul> <b>Infrastructure Savings Over Time</b> <ul style="list-style-type: none"> <li>• Inability to Share Savings</li> </ul>	<ul style="list-style-type: none"> <li>• Rotating Fund</li> <li>• Better Prime Profit Split</li> <li>• Pre Contract Relationship Agreement- Prime/Supp/Customer</li> </ul> <ul style="list-style-type: none"> <li>• Increased attention by Acq Reform</li> </ul> <ul style="list-style-type: none"> <li>• Regulatory Change</li> </ul>

*Figure 13. Barriers, Enablers, and Metrics to Track Commercial Technology Insertion*

## Summary

The workshops pointed to several paths of changes that could effect the increased use of commercial technologies in defense systems. Some of these paths intersect; e.g. the solution to some of the metrics required result from actions taken to resolve incentives to get program managers to take more risk in commercial technology. What we have is a start on the path to defining the feasibility of using commercial technologies in a "Spin-On" concept. It appears from the positive receptivity demonstrated by each of the participants in both workshops and in the one-on-one/two on-two interviews that the basic idea is sound. While there are significant barriers, none are insurmountable and only one or two of these barriers are outside the authority of the Department of Defense to address. Recapping these workshops, we addressed some ideas and issues that are continually surfaced in other gatherings of defense business leaders.

The expansion of the Other Transactions Authorities (OTA) has been proven to be a significant method to reduce overhead and infrastructure costs. It is also not very well understood by both sides of defense acquisition, but should be. Government intrusion into data, audits, oversight, cost accounting, and allowable profit margins remain significant barriers to increased commercial company involvement in defense products. These barriers must be addressed. The general awareness of defense needs by the Industry (both large and small companies) can be greatly improved. Methods to increase information sharing (especially in regard to cost-driving problem areas) are needed. Large "Prime Contractor" companies hold the key to information exchange, technology insertion, and the level of participation of small and non-traditional defense suppliers. Energy spent to nurture this relationship will be of significant benefit to defense affordability. Transition to commercial best practices, if desired by the Department of Defense as a cost cutting measure, must be made in full. Mixing piecemeal, selective components of commercial practices with traditional acquisition practices may not be as successful. The need for a Government organization infrastructure to assist in transitioning technology is probably not a good idea. The attendant intrusion far outweighs any benefit. Policies regarding testing for qualification and testing for

operational suitability should be reviewed for possible collaborative changes. Cultural changes attendant with the acceptance of “price” vice “cost” should be advocated and nurtured.

# APPENDIX 1

## WORKSHOP PARTICIPANTS

### "Prime Centric View"

Mr. James Sinnett, VP Boeing  
(Chair)  
Mr. Page Hoeper, DUSD (I&CP)  
MGEN Roy Beauchamp, Cmdr  
TACOM  
Mr. Ward Collins, Dow-Corning  
Dr. Lance Davis, Dep DDR&E  
Mr. Ron Finkbiner, VP Lockheed  
Martin  
Mr. Robert Neal, Jr. OSD/SDBU  
Dr. Richard Kegg, VP Cinn-  
Milacron  
Dr. Mike McGrath, OSD  
Mr. Herm Reininga, VP Rockwell-  
Collins  
Mr. Dan Porter, Navy Acq Reform  
Exec  
Mr. Jerry Harrison, VP Motorola  
Dr. Jay Mandelbaum, OSD  
M. Joe Syslo, NCAT Facilitator

### "Tiered View"

Mr. Herm Reininga, VP Rockwell Collins  
(Chair)  
Mr. Mike Damuth, Alfalaval Separation  
Inc  
Dr. Santosh Das, Allied Signal, Inc  
Dr. Lance Davis, Dep DDR&E  
Mr. Page Hoeper, DUSD (I&CP)  
Mr. Ed Howard, NOAA  
Mr. Rick Jarman, VP Eastman Kodak  
Dr. Jay Mandelbaum, OSD  
Mr. Mike Michno, VP AMOCO  
Dr. Rich Mirsky, JDUPO  
Mr. Boyd Mueller, Howmet Research  
Corp.  
Mr. Steve Olsen, VP Raytheon Systems  
Mr. Ralph Resnick, Extrude Hone Co  
Mr. Rush Robinett, DOE Sandia  
Mr. Jeff Ruckman, Dir Ctr Optics  
Manufacturing  
Ms. Jeannine Shirley, NASA  
Mr. Rob Hertzfeld, OSD  
Mr. Joe Syslo, NCAT Facilitator

### Individual Interview Participants

Mr. Terry Porter, Texas Instruments  
Mr. Rich Forselius, Hamilton Standard  
Mr. Art Naselow, GM Hughes  
Mr. Gordon Neary, McDonnell Douglas  
Mr. Eugene Steadman, Hoechst Corp  
Mr. Paul Stone, Dow Chemical  
Dr. Richard Van Atta, IDA  
Dr. Jay Mandelbaum, OSD  
Mr. Joe Syslo, NCAT

## APPENDIX 2

### *READ AHEAD MATERIAL*

#### *“Prime Centric” View Workshop*

## **Advancing Insertion of Commercial Technologies from Non Traditional Sources into Defense Systems *A Workshop Prospectus***

### **Vision on Commercial Visibility and Access**

To increase the affordability of defense systems, DoD has the following vision:

- DoD and Industry managers have visibility of and access to the full range of prospects for using the best commercial technologies to reduce the total ownership costs of military systems.
- DoD is able to evaluate the utility and, where the return on investment is sufficient, exploit the benefits of these commercial technologies in new acquisition and system modifications and upgrades.

### **Barriers Create Need to Improve Visibility and Access**

Hypothesis: Even assuming that acquisition reform implementation and its associated cultural changes become widespread, two significant barriers to the realization of this vision will remain:

- (1) DoD program offices and their prime contractors will not have visibility and access to the full range of prospects, especially from non-traditional suppliers (commercial companies, small businesses, international companies).
- (2) An effective and efficient infrastructure will not be in place to link the companies that have commercial technology insertion prospects with the prime contractor and program office that would act on such prospects.

We have hypothesized these barriers because of the following observations:

- DoD programs do not (and should not) conduct surveillance on the commercial markets to keep abreast of all of the latest commercial innovations that might reduce the total ownership costs of their system. It

is a large and difficult undertaking. Without such information, DoD is not able to be a smart buyer – even with performance specifications; it is hard to buy something without knowledge of its existence. Consequently, DoD relies on its prime contractors to sort out the myriad ideas for commercial technology insertion and rank them based on return on investment (ROI) to the government.

- Non traditional suppliers have difficulty in providing visibility and basic knowledge of their technologies to program offices. It is often difficult to know whom to contact within DoD and there is very little infrastructure to help these non-traditional suppliers link with defense programs. Because commercial suppliers are generally so removed from defense applications it is most likely that direct contact with weapon's program offices would be inefficient. Some preliminary screening is needed to eliminate less feasible proposals and to identify simultaneously the best opportunities for defense application. While large commercial companies may have the resources to cut through the bureaucracy, they may not want to make the effort because of perceived issues about doing business with the government (red tape, relatively low product demand, and budget uncertainties). Small companies, because of resource constraints, and foreign companies, due to a variety of perceived barriers, generally have more difficulties accessing DoD programs and are therefore less able to make the proper contacts.
- Non traditional suppliers have difficulty in gaining visibility of their technologies with prime contractors. In most instances, DoD prime contractors are dealing with a limited set of more traditional defense suppliers. All primes are in the process of reducing the number of suppliers and building "partnership" relationships with the few remaining ones to enhance quality and minimize product development cycle time. Under these circumstances it may be increasingly difficult to create relationships with non-traditional suppliers. In addition, inserting commercial technology or products into DoD systems is not always consistent with the prime contractor's strategic business development plan. It may lead to lower revenues and fewer long-term opportunities to expand business. Opportunities for joint ventures often are not readily apparent.

### **Workshops Proposed to Address the Need**

To address the issues of "the Government's role in establishing an infrastructure that provides routine visibility and access to a wide range of commercial technology insertion opportunities," we propose a series of Industry-Government workshops. The first workshop would focus on prime contractors and subsequent ones would focus on sub-tiers and commercial firms. Procedurally, we would lay out the vision, the barriers, and proposals for participants to react to.

## **Preliminary Concepts for Improving Visibility and Access**

The following identifies preliminary ideas on overcoming these barriers. All of these ideas would include an outreach effort to all suppliers of commercial technologies that (1) informs them of DoD's desires to use commercial technologies to reduce costs; (2) encourages them to develop proposals for DoD to use their commercial technologies in military systems (spin-on) to reduce life cycle costs as part of a mod or upgrade; and (3) dispels perceptions about disincentives in doing business with DoD.

- (1) DoD should develop incentives for prime contractors to take active steps to identify and receive commercial technology insertion opportunities from non-traditional suppliers. The prime contractor in effect would serve as an initial point of contact into the DoD bureaucracy for suppliers who want to market their ideas. It would be incumbent on the prime contractor to evaluate the prospects and make proposals to the program manager for their implementation. Potential issues with this idea include (i) it may not be in the prime's strategic interest to use the technology; (ii) there is the possibility of opening a floodgate of poorly formulated proposals; and (iii) a burdensome screening process may have to be implemented.
- (2) DoD should create "technology scouts" whose functions would include (i) maintaining an expertise in a wide range of technology areas; (ii) serving as an advertised (through a DoD outreach effort) initial point of contact in DoD; (iii) proving an initial evaluation of the feasibility of prospects; and (iv) linking the more feasible prospects with DoD programs that might implement them.

A variety of possible mechanisms are available to perform the "technology scout" function. These include:

- (a) The Militarily Critical Technology List (MCTL) infrastructure. Some linkage to System Commands or PEOs would have to be created in order to match prospects with the appropriate program offices. Potential issues with this option include (i) the possibility of overwhelming the system with too many prospects; (ii) the need to establish more formal links with programs; and (iii) the potential costs of a screening process.
- (b) The DoD technology transfer infrastructure could also assume the technology scout role and arrange for the initial evaluations to be performed. Some linkage already exists with program offices.
- (c) RTTC/NTTC infrastructure. Connectivity to defense programs would have to be created.

Potential issues with the latter two options include (i) the possibility of overwhelming the system with too many prospects; (ii) the linkage to programs is through R&D people – they may be too removed from both

military applications and commercial products to be effective in assessing and communicating insertion opportunities; and (iii) the potential resources needed for a screening process may be large.

- (3) Create "technology bounty hunters" in the private sector whose job would be to find these opportunities and who would be paid on the basis of the realized cost savings to DoD. It would be incumbent on these bounty hunters to be the first point of contact, to perform the initial evaluation, and to link with the proper program. Work must be done to earn the bounty. Poor work will not lead to a payoff. Potential issues with this idea include (i) difficult to find mechanism to "fund a bounty"; (ii) not clear if motivation is sufficient; and (iii) may create friction with prime contractors.

### **Taking Advantage of Opportunities**

Acquisition reform and programs like the Commercial Operating and Support Savings Initiative (COSSI), the Commercial Technology Insertion Program (CTIP), and the Reliability, Maintainability, Availability (RMA) Initiative offer opportunities to act on such commercial technology insertion prospects.

### **Desired Workshop Products**

- (1) Agreement on a shared vision of how to improve access to and visibility of non traditional commercial technology opportunities;
- (2) A more complete and insightful understanding of the barriers;
- (3) A prioritized set of concepts for improving visibility and access; and
- (4) Recommendations on pilot programs.



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## **Appendix M**

### **Sample of Roundtable Proceedings and Briefings**

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Final  
PROCEEDINGS  
**Defense Manufacturing Roundtable**

Washington, DC  
May 9, 1997

## ***PROCEEDINGS OF***

### **The Defense Manufacturing Roundtable Washington, D.C.**

May 9, 1997

The May 9, 1997 Defense Manufacturing Roundtable was held in the Wright Room of the National Center for Advanced Technologies. The meeting convened at 3:00, Stan Siegel, President, NCAT welcomed participants. The meeting agenda and list of participants are at Attachment 1.

Joe Syslo of NCAT moderated the discussion, opening with the presentation of issues to be discussed, and a brief review of the critique of the program made by the Technology Area Assessment & Review (TARA) team review earlier this spring (Attachment 2).

During the group discussion Dr. Lance Davis proposed a "strawman" plan that could potentially address each of the issues revolving around the Manufacturing Technology program. The pertinent portion of Dr. Davis' presentation is at Attachment 3. Key points of the DDR&E "strawman proposal" and the attendant arguments follow:

#### **1. Reduce the Scope of the Program**

- Phase out Level of Effort (LOE)

Because ManTech program resources have been reduced over the past few years to a level of approximately \$90-100 million a year, and the TARA review had recommended larger projects (\$25-\$50 million) that have "critical mass" goals and "pervasive" impact, the "strawman" proposal suggested a phase out of level-of-effort factory floor ManTech projects. The "strawman" proposed factory floor projects would become the responsibility of the appropriate weapon system program management in all phases of the program's life cycle.

There was general disagreement with this proposal. Strong opposition from Industry, specifically from the viewpoint of the small company, whose ability to leverage small dollar value projects (less than \$500k) would be severely curtailed by this "strawman" recommendation. It was pointed out that there have been several, low dollar value shop-floor process projects that successfully impacted manufacturing technology to the benefit of multiple programs. The participants agreed that select, high payoff level-of-effort projects should continue to be part of the risk reduction spectrum of ManTech. There was extensive discussion revolving around the topic of high-leverage, smaller dollar value, ManTech projects that would fall out under this proposal. There have been a number of successful projects that solved single, user-specific problems such as

composite structural repairs, and repainting of aircraft, that would not have been completed if not for ManTech. A suggestion was made and a recommendation followed to attempt to programmatically aggregate and manage portfolios of smaller dollar value efforts that addressed single user, important technology problems.

- Transition responsibility to the Weapon System Program Office (WSPO)

There was strong disagreement with transitioning the responsibility on manufacturing technology requirements to the weapons system program office. The argument from the Industry participants offered that "ManTech is both sides of the equation, "on-the-shop-floor" and above-the-shop-floor." Argument from other participants concluded that the program should address all current requirements, transfer technologies across programs, and include applicability throughout a program's life cycle. The discussion addresses past experiences that indicated that WSPO's would concentrate their scarce resources to solving their own program's problems. The synergy of multiple service resources seeking multiple solutions that are applicable across programs would be lost in this "strawman" recommendation.

## **2. Maintain Service/DLA ownership of Program Element 7.8**

This part of the "strawman" proposal dealt with maintaining the ManTech program as part of the S&T planning process while recognizing that technology transition was a primary facet of the program. Hence the proposal for maintaining a program element 7.8 linkage. Resources located in the R&D and Industrial Base program resource accounts were proposed as an effective method of "bridging" the manufacturing technology through the entire life cycle of a program.

There was general agreement among the participants with the planning process remaining within the program elements currently assigned, i.e. 6.2/6.3 and 7.8. There was also general agreement that the services need to continue to be firmly involved with the planning and execution strategy of the ManTech Program. The Joint Defense Manufacturing Technology Panel (JDMTP) continuing operations in spite of the disestablishment of the JDL Reliance structure was seen by the participants as the appropriate activity to plan and prosecute the program. It was noted that the absence of sponsorship by the Joint Directors of Laboratories could have some deleterious effect on the operations of the JDMTP. But that has not occurred. Further discussion on sponsorship is noted in the last paragraph of these proceedings.

## **3. Transfer Centers of Excellence (COEs) to a separate COE Program Element**

The "strawman" proposal dealt with the COE funding issues in this president's budget submittal (and subsequent COE-resource activities) by divorcing the Centers from the entire manufacturing technology planning and execution process.

General discussion around the table dealt with the resources issues surrounding the centers, how centers might participate in the execution of pertinent parts of the program, how resources were and could be allocated to the centers, and how the services used or did not use the centers. It was generally agreed that the centers issue would not be resolved unless there were a "center strategy" planned by the department and services that would include all the activities of programming, planning, budgeting and execution for the ManTech program including the Centers of Excellence. Discussion touched on the possibility of forming an Industry/Government/Center process action team to address the issue.

#### **4. Establish ownership of ManTech with the (Service Acquisition Executives) SAE's**

The "strawman" proposed sponsorship of the Joint Defense Manufacturing Technology Panel, which was operating without charter after the dissolution of the JDL structure, residing with the Service Acquisition Executives. The Services Acquisition Executives and the DDR&E could charter the JDMTP organization and thereby fill the sponsorship void and guide the ManTech activity. The SAE role in this activity would be to keep the services firmly involved and mitigate across functional "stovepipes" of service programs. There was lively discussion earlier in the Roundtable that the program needed a "champion" in the OSD structure. This part of the "strawman" proposal again brought that notion to the table.

There was general agreement that some higher level of sponsorship was necessary. It was discussed and agreed that the sponsorship required would more likely reside at the Defense Acquisition Executive (DAE) level along with support from the SAEs. Conversation revolved around the potential of this notion being briefed to the Defense Manufacturing Council.

#### ***Actions resulting from the Roundtable***

It was recommended that the "strawman" proposal be "repackaged" to reflect the conversation and general agreement of the participants. The participants further recommended that this revised strawman be presented to the Defense Manufacturing Council now the Defense Systems Affordability Council at a future council meeting, with potential presentation to the SAEs/DAE upon endorsement by the DSAC. Subsequent presentation to the acquisition community at a future PEO/SYSCOM was discussed. The possibility of forming an Industry/Government process action team to address process and planning was discussed. Further prosecution of these notions would await the decision of the Defense Systems Affordability Council subsequent to the June 2 presentations.

The action to repackage and coordinate the "strawman proposal" was given to NCAT. The repackaging would reflect the following notions and be incorporated in revised sections of the "strawman proposal":

- Top Down Direction
- Portfolio of ManTech Programs built on Technology Requirements
- Revisit "Thrust Areas" for ManTech program focus
- Continue the full spectrum manufacturing program "On-the-shop-floor" and "Above-the-shop-floor."
- Harmonize ManTech projects among the services to retain the strength of "jointness"
- Keep the Industry involvement in the planning and execution of the program to insure broadening of the industrial base.

(The revised "strawman proposal" briefing charts are included as Attachment 4.)

### **Concluding Comments**

The Roundtable series has continued in its effectiveness to allow informal dialogue to address and resolve knotty problems. All participants agreed that this Roundtable discussion of the ManTech issues was a valuable, healthy exercise and brought closer understanding and agreement on a plan and direction to resolving the current issues.

The general consensus of the participants was to sponsor briefing these ideas to the DSAC once review of the repackaged strawman proposal was completed. The decision to form a process action team to address the COEs issue and other planning and procedural issues was also discussed and deferred until after the DSAC presentations on 2 June 1997.



# Attachments to Roundtable Proceedings

Attachments 1 thru 4



*National Center for Advanced Technologies*

## “Roundtable”

- Charles Browning, AF
- Dick Chait, SARD
- Dottie Comassar, GE
- Dan Cundiff, OSD
- Lance Davis, DDR&E
- Paul Ehle, AMC
- Helmut Hellwig, SAF
- Scottie Knott, DLA
- Mike McGrath, OSD
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- Doug Swiggart, Lockheed
- George Williams, SAF
- Herm Reininga, Collins
- Larry Rhoades, ExtrudeHone
- Joe Syslo, NCAT, Moderator

Atch 1

## ManTech Accomplishments & Impact

### Accomplishments

### Impact

- |                               |             |   |
|-------------------------------|-------------|---|
| • Fiber placement process     | Composites  | • F-18E/F xfer to F-22, V-22, C-17, T-45, CAV, JSF  |
| • High efficiency solar cells | Electronics | • Reduce satellite launch & O&S \$<br>• Improved rad & temp tolerance<br>• 40% size/power trade |
| • Optics mfg                  | Metals      | • Reestablished U.S. indus. base<br>• 20% cost reduction<br>• In 20 targeting systems           |

Atch 2/a

## ManTech Accomplishments/Impact (Con't)

### Accomplishments

### Impact

- |   |             |   |
|---|-------------|---|
| • Application Protocols for composites, metals, & electronics | M & ES      | • F-18E/F & F-22; multiple CAD users 18% savings in direct labor              |
| • Commercial Mfg of military electronics                      | AI P        | • Expanded DoD definition of commercial items 30-50% cost for F-22 & Comanche |
| • Low cost, "green", paint removal                            | Sustainment | • B-52, E-3, C-135 & Ships  |

Atch2/b



## National Center for Advanced Technologies



Atch2/c



## ManTech DDR&E Issues - Strawman Proposal -

**Given Reduced Funds Available to ManTech (e.g., \$90-100M/yr)**

- Reduce scope of program to high leverage, ATD-type programs in Mfg & Engineering Systems and Advanced Industrial Practices
  - > Phase out "level of effort" factory floor investments in electronics, metals, & composites
  - > Transition of factory floor processes from R&D to manufacturing becomes responsibility of weapon system PM/SPOs, logistics managers, & materials community
- Maintain Service/DLA ownership of 7.8 PE
  - > Maintain ManTech program as part of S&T planning process
  - > Services/DDR&E must recognize value of ManTech as a transition program in 7.8

Atch 3/a

19



## ManTech DDR&E Issues

- Strawman Proposal (con't) -

- Transfer Centers of Excellence (CoEs) to a separate CoE PE
  - > Transfer funds to CoE accounts at FY98 PBR level
- Establish ownership of ManTech with SAEs
  - > SAEs can provide sponsorship across functional stovepipes
  - > Develop a Joint ManTech Panel charter for SAE and DDR&E signature

Atch3/b

20



National Center for Advanced Technologies

## STRAWMAN PROPOSAL "REPACKAGED"

9 May 1997

Attach 4

# STRAWMAN PROPOSAL

## **(1) Program Scope**

- Target projects that offer high payoff, and provide a pervasive impact, including high leverage LOE, for Mantech funding
- Address both “On-the-shop-floor” & “Above-the-shop-floor” system driven, defense essential requirements
- Programmatically aggregate and manage “smaller” efforts that address single, identifiable, user-important problems

# STRAWMAN PROPOSAL

## **(2) Program Ownership**

- DAE Leader
- Establish SAE Ownership

# STRAWMAN PROPOSAL

## **(3) Program Execution**

- Maintain JDMTP structure
- Direct Program “Top Down”
- Generate Requirements “Bottoms Up”
- Harmonize Services’ Programs (JDMTP)
- Include COE Strategy for Execution
- Build “Portfolio” of Pervasive Technology Requirements and/or “Thrust” Areas to Broaden Industrial Base

# STRAWMAN PROPOSAL

## **(4) Program Guidelines**

- Maintain Military Essentiality
- Eschew Proscribed Cost Sharing
- Discourage Mandated Program
- Support requirements generated resource levels at all echelons
- Maintain Industry Planning Partnership

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